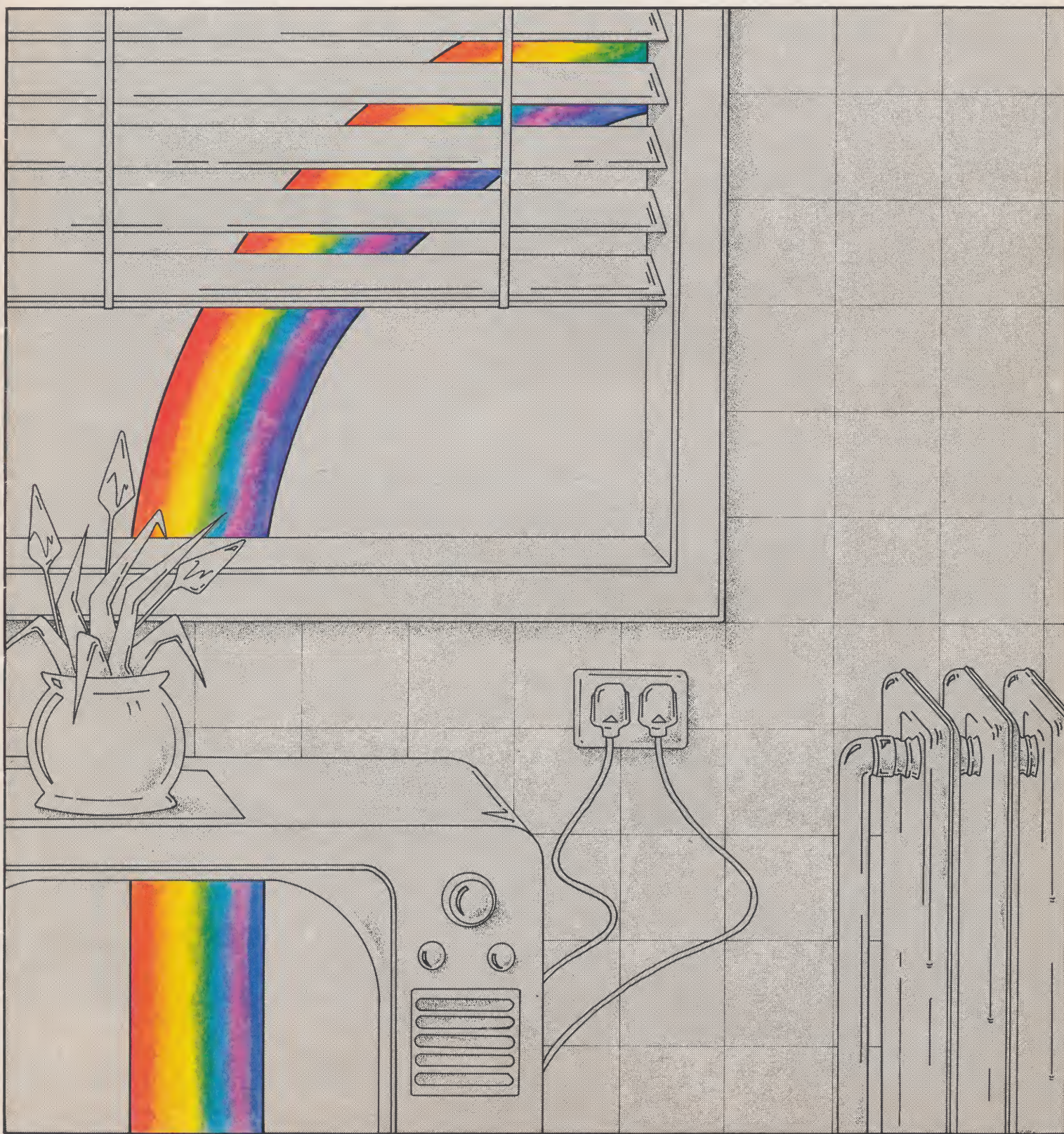


VIC COMPUTING

April 1982 Vol 1 Issue 4

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Elsewhere in the world this excellent program for developing your very own graphics symbols and alternative character sets is being sold for folding money. We give it to you for free — part one now, part two next issue . . .

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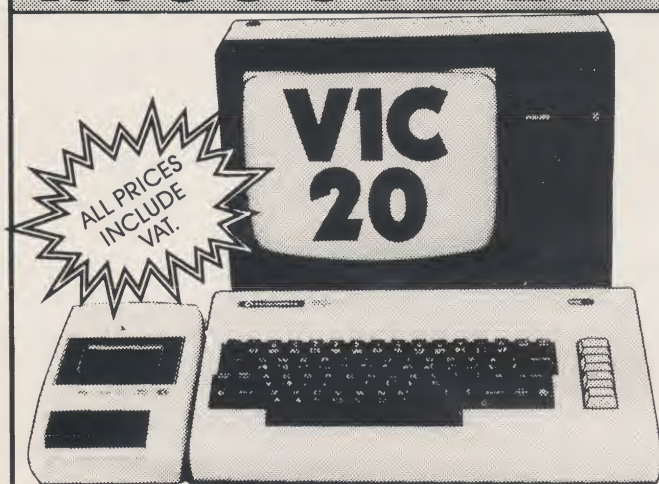
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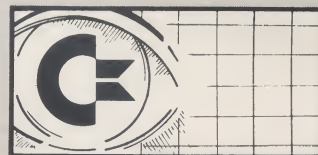
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Eye on Commodore



If you want an Authoritative Comment from An Industry Source on Commodore's announcements about a 'universal' computer with plug-in emulators for other systems, you might try for a contribution from John Roach. He runs the Tandy organisation and has a reputation for being — candid, shall we say? Asked for a view on the perhaps premature announcement by Commodore he replied succinctly: "Horse manure". Oh, come now. Who uses the word 'manure' these days?

And on the subject of useful quotes with which to impress friends and acquaintances while queuing at the Job Shop, here's a World View from Commodore's president Jim Finke (as cited in the US magazine *Byte*): "The personal computer market is about the same size as the total potato-chip market. Next year it will be about half the size of the petfood market and is fast approaching the total worldwide sales of pantyhose".

He doesn't really mean chips, of course, he means crisps. Anyhow, there's no equation between quantity and quality (a fact which accounts for Tandy's success?) and the personal computer market has a long way to go before it approaches the sheer class as well as the volumes of the pantyhose business.

But on the question of size and success in the personal computer business (and quotable quotes about it), here's a somewhat double-edged comment from one of the analysts who works for a Wall Street stockbroking firm: "Pac-man will make more money for Warner than the movie 'Star Wars' made for Twentieth Century Fox".

What's that again? Well, Warner owns Atari and Pac-Man is a slightly advanced gobble game. Pac-Man zips around a tricky maze pursued by aliens and downing 'video wafers' and 'power pills' to give him the speed and the resilience to fight back.

Ho hum, you might think. Well, Atari reckons it will sell \$200 million worth of Pac-Men this year alone.

'Power pills', eh?

Elsewhere in the world, we hear there's a new Sinclair machine due to be launched soon — at the end of March, said the rumour mill the first time around, but that date has clearly

passed without sight or sound of it. Maybe one of the forthcoming computer fairs will see it.

Anyhow, the new Sinclair was reportedly designed virtually from scratch and rushed into production in a matter of months. Why? Largely because Clive Sinclair was stung into retaliation by the Department of Industry's exclusion of the ZX81 from the official favours (and guaranteed markets) bestowed on Research Machines and Acorn when schools were given 50 per cent grants to do their computer shopping at Research Machines and Acorn.

The professional Sinclair-watchers are calling the new machine the ZX82, though that probably won't be the official name. It probably won't obsolete the ZX81: Sinclair's cheap introduction to computing definitely has a year or two of marketing life left in it yet.

Instead, we hear, the new product will be a head-on competitor for the BBC micro — not least because that's another case of semi-official selection that again passed the Sinclair organisation by. There's an alleged resemblance in the Basic to the BBC's Acorn-made offering, so there should be some compatibility at the program level. As for price, the phrase we were quoted was "cheap enough to make Acorn sweat".

The new Sinclair machine will almost certainly be A Good Thing, even if Sinclair products do have something of a reputation now for improving radically in their Mark II version. Apart from anything else, WH Smiths will be selling it: Smiths is reportedly considering the Vic, too, so it's just possible the two low-cost micros will be on view side by side later this year. What's more the new computer should force down the price of the ZX81 to something like £50 or so, making it an even cheaper intro to computing: that can't be bad, either.

And where does the Vic fit into all of this? Well, it looks as though Sinclair will be able to best the Vic's Basic but not its price. The target price, we hear, is something around £240. Commodore is obviously keeping a wary eye on Sinclair, but it has a head start — it's Commodore that has the distribution fixed up and most of the bugs ironed out and the production rolling.

News

Compete!

Commodore has launched a program-writing competition with prizes valued at over £1,500. Winners also get the chance to benefit from royalties on successfully-marketed entries.

Submissions are invited for any type of program designed to run on the Vic-20 or Commodore PET 4000 series. Preferred entries will be both inventive and instructive," comments Commodore. "They should be designed for use as a primary, secondary or special schools educational program: or for programs devised for a home application".

First prize consists of the Vic single-drive floppy disk unit, the Vic printer, and the Vic programmers aid cartridge — all new and good. Second prize is the Vic disk drive and the programmers aid cartridge: and third prize is the printer plus the cartridge.

Entries should be sent to Commodore Software Competition, 35 Garway Road, London W2 4QD no later than 30 June 1982: and you'll need to include the coupon at the foot of the page.

There's another competition in the air. The big computer manufacturer NCR is sponsoring a competition to highlight the work done by students involved with computing or business studies and electronic engineering for communications and information systems. The competition is open to students aged between 18 and 25 and will be based upon the project or thesis that such students will be submitting in connection with their studies this year.

Each university, polytechnic and college or institute of higher education may enter up to two projects — they must be the work of an individual, not a team.

The entries will be judged on a regional basis by a team of independent experts. The best from each of the twelve 'IT 82' regions in England, Scotland, Wales and Northern Ireland will go forward to the finals in early December in London where they will be judged on their originality, "benefit to society" and the advance of "information technology".

And at the end of it all, the winner will go to the States at NCR's expense. The regional winners will have their expenses paid to attend the finals in London and will receive a commemorative plaque.

Well, a trip to the States sounds fine — even if it is bound to include a visit to NCR's home town of Dayton, Ohio, a city which makes even Motherwell look like a nice place to be on a wet Sunday. A visit to London and a plaque will probably be of less appeal these days, though. It's a shame NCR doesn't make Vic-sized computers that it can give away...

The closing date for the NCR Information Technology Student of the year Competition is 31 October 1982. For details contact NCR's Michael Fenton Webster on 01-388 8244.

Plug In

Somehow the spring seems to bring out all the microcomputer shows. Vic enthusiasts, what will probably be the biggest and the best is the burgeoning Commodore-organised Commodore Computer Show in June.

The third of that ilk will be held at the Cunard Hotel in Hammersmith between 3 and 5 June. More than 100 exhibitors will be there — including **Vic Computing**, of course! — and the organisers are expecting 20,000 visitors.

Goodies at the show will include "many exciting innovative products from Commodore" (says Commodore) as well as original programs and add-ons from the 'approved product suppliers'. Commodore's bit should include the latest collection of products, including the extraordinary Ultimix (and it is extraordinary — extraordinarily ugly, extraordinarily good value).

The stand should also have the Vic-40, at which we cast a furtive peek some time ago. It looks like the Vic-20: it gets the same Basic, we think: and it can use the same peripherals. But it isn't a simple plug-in upgrade for the 20, it's a completely new machine. And it can't use the Vic cartridges: instead it has the same kind of connector as the Ultimix, so it is the Ultimix's cartridges that it can use.

It also uses the same processor as the Ultimix, the 6510 chip rather than the 6502. Basically the difference is that the 6510 has an extra eight-bit I/O processor, so it can run more memory without the need for clever internal memory management facilities.

More significantly, the Vic-40 and the Ultimix use two chips for the sound and video control. The Vic-20 has just one, and separating the functions means that the newer products can do a lot more. The 6581 SID (Sound Interface Device) gives you three 'voices', each of nine octaves: four waveform possibilities: and a programmable ADSR envelope for each sound. If that means little to you, just take our word for it that it makes the Ultimix and the Vic-40 pretty versatile tone generators.

The other new chip, the 6566 video controller, is also pretty smart. In a 320-200 matrix, with 16 colours available, you can define up to 256 graphic shapes called 'sprites'. These can be moved over and behind each other, and they can appear to collide as well. The 3D effect is great!

The Vic-40 comes with 16 or 64K memory — though only 38K of the upper size is available for user programs. Existing Vic and Pet software can be converted quite easily to run on the Vic-40, says Commodore.

Future goodies will include a plug-in Zilog Z-80 emulator, as discussed in last issue's 'Eye on Commodore'. There will also be soft-loaded languages — Pilot, Pascal, extended Basic. And the price? Commodore dealers are being told that the 40 will fall between £300 and £500: and they should be able to start selling it in the late Autumn.

If you want to stick with Commodore for a more serious commitment to computing, take a look at the other new stuff that will/should be on show in Hammersmith. These are the Commodore 64 and Commodore 128. The 64 is effectively a Vic-40 with a different keyboard (ten function keys, separate cursor controls, a numeric keypad as well as QWERTY) and more memory (64 to 128K). It will also support the big floppy disk unit, the one-megabyte 8050 as usually sold with the 8032 Pets.

The Commodore 64 will still have a separate monitor. The Commodore 128 will have an integral screen and floppy disk drives, and a price tag of over £2,000 to set against the £500 to £700 that you'll be paying for the 64. The 128 is clearly a different animal — reportedly styled by Porsche, with the kind of ergonomic design (sculptured keyboard, tilting and swivelling screen, and so on) that should make it a competitor for the Sirius and IBM Personal Computer.

So go to the Commodore Show to see what Commodore's got in store for you: call Slough 79292 for details.

Mistack

Some baffled readers might have spotted that the Stack ad in our last issue included out-of-date prices. Our apologies to all concerned. Oops. Well, in mitigation we can point to the fact that we'd only just taken over the mag then: and the advertisement itself had to be passed on from another publisher, who sent us the wrong material. But we didn't check it. So we're very sorry. Sorry, Stack.

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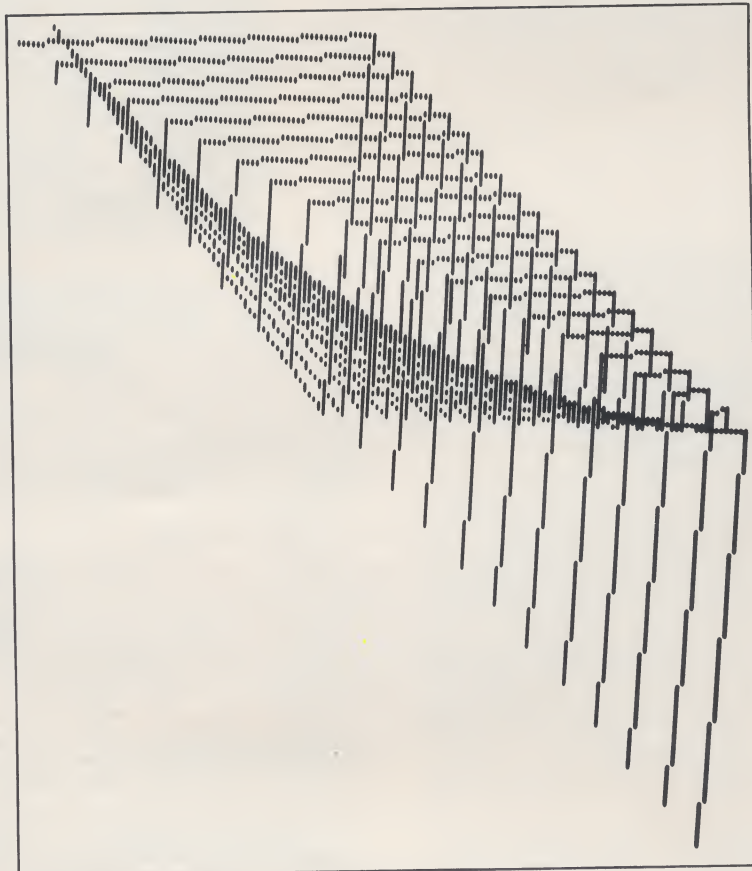
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Expanding with Arfon

by Chris Durham

Chris received his long-awaited Vic-20 in October 1981. By the middle of November he was well immersed in writing programs and "trying out the many and varied features of this excellent machine". When he bought a Super-Expander cartridge and received a free 3K RAM cartridge from Commodore (a welcome gesture when all the transformers were recalled), he decided that with 6.65K of user RAM he could start on the bigger programs. "Before long" he relates "I was seeing tempting advertisements for goodies like Programmer Aid cartridges, Machine Code Monitor cartridges, more expansion memory cartridges — the Vic can only accept one cartridge at a time."

So he started thinking about an expansion unit, an add-on device which would allow a number of cartridges to be used simultaneously. The Commodore 'motherboard' expansion unit was not available; but in the depth of Wales Arfon had seen the requirement and produced its own Vic expander.

Chris bought one and now reports on it.

Not having seen the Arfon unit before, I was somewhat startled by the enormous box that was finally delivered. On removing the (well-packed) unit, however, all became clear: it is designed to hold the Vic as an integral part of the system — and a very snug fit it is too.

It is solidly constructed from heavy-gauge aluminium painted to match the Vic. The on-board power supply is totally enclosed in a metal box which can only be unscrewed from beneath

the unit. The mains lead is quite long, but it's nowhere near the length of the combined mains and low-power leads of the original transformer. The Arfon expander does come complete with a three-pin 13 amp plug, though, which is more than one can say for the Commodore box. The new power supply replaces that supplied with the Vic: it consists of a toroidal type of transformer, which means quiet, cool and vibration-free operation. The transformer supplies three separate voltages; 5 volts for the expansion board, 9 volts for the Vic and 24 volts which goes to a socket on the side of the unit according to the glossy brochure this is for the Arfon 'Micro Printer' when it appears. It's purely a power socket, however, and the printer will still plug into the serial port in the back of the Vic.

The expansion board itself consists of a PCB containing five ICs, a few discrete components, and seven expansion sockets (which is one more than the forthcoming Commodore expansion system). Only time will tell if seven are all really going to be of use simultaneously, but more of that later. The expansion board is firmly screwed to the unit with six screws: and that fact will achieve real significance later on.

There are a number of large slots cut in the side. One allows access to the games port on the side of the Vic. The others are large enough to permit a user-port plug to pass through, so that cables can come in from peripherals with the plug already on.

At the back behind the expansion board is an inverted three-sided piece of metal, rivetted not very firmly to the base. This, explains the brochure, is to hold the UHF modulator unit — a job it does quite well in fact.

Fitting the Vic

The first job is to fit the Vic on to the expansion unit. The instructions warn that it is a tight fit between the side walls, and they are not joking. Great care needs to be taken to avoiding pushing too hard and suddenly ramming the Vic into the PCB connector. The non-slip feet on the Vic guarantee that the one thing you cannot do is slide it gently into place. The trick is to lift the front of the Vic very slightly — but not too much or you will catch the PCB connector at an angle and risk breaking it.

It was at this point that I hit the first snag. The Vic resolutely refused to slide on to the connector. Since the expansion socket is inside the Vic, it took a little while to discover that the socket and the connector were out of alignment by almost a quarter of an inch.

The Vic cannot move laterally between the side walls: and the PCB seemed firmly secured by those six screws. So it looked like an impasse. Closer examination of the screws, however, showed that there is a nut and washer securing them under the unit. Loosen the screws: and bingo, oblong holes are revealed. These are large enough to permit about a quarter of an inch of movement: so by moving the PCB from one extreme to the other I was just able to slide the Vic back to engage the connector. I don't think that it would have done any harm to have made those six holes even wider and thus remove any suggestion of strain on the board when a big adjustment is needed. There's a small hole at the front of the Arfon unit to allow the Vic to be screwed into it to avoid any movement, but I have not found this to be necessary.

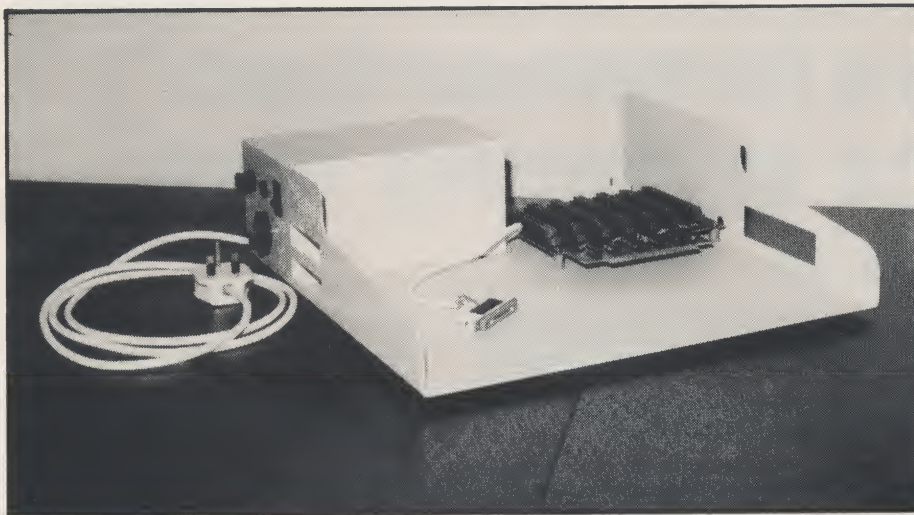
Once the Vic is in, the final task is to connect the power supply by plugging the cable into the user-port on the Vic. The cable comes complete with a user-port plug and clear fitting instructions.

The power on-off switch on the Vic is now redundant, a power switch being provided on the side of the unit. This has the major advantage that it is now the mains which is switched on and off and not just the 9V supply: no longer do you have to unplug the transformer at the end of each session. To add to the safety aspect, the power supply is protected by a 500mA 250V fuse next to the switch.

Using the thing

When you start to plug in your cartridges you come to the second snag. A 3K RAM cartridge fits without any problem. Try an 8K cartridge, though, and it may not fit. Arfon has put two keyways in each socket so that cartridges cannot be fitted the wrong way round. The 3K





cartridge has two slots; my 8K RAM pack has only one.

This may have been an oversight on my cartridge. But in any case the keyways are easily removed with a pair of thin-nosed pliers. Do make sure that you only take out one of the keyways, if necessary, otherwise you might have problems in the future.

Once the cartridges are firmly fitted, you can switch on. The Vic's red power light should come on as normal. If you have a ROM cartridge fitted, you'll be in action straight away; but since there is no way of 'switching out' any of the sockets, clashing ROM cartridges cannot be plugged in together.

I see no reason why a small DIL switch-bank could not have been added, connected to the two end sockets for example. This would have allowed one or neither to be connected, thus saving a lot of cartridge changes and the corresponding wear on the connectors.

With ordinary memory cartridges fitted you get your screen message of 'X' bytes free where X is the total memory plugged in, less the operating system chunk . . . Or is it? The instructions point out that if you have an 8K (or a 16K) expansion fitted, any 3K RAM cartridge (or a 3K RAM area in a RAM/ROM cartridge) will be ignored.

The reason for this is that when the total RAM available to the Vic exceeds 8K, the location of the screen map changes effectively isolating the lower 3K RAM expansion area. So when the Vic searches to see how much memory it has, that 3K area is completely ignored and does not appear on the screen total. This means that the maximum free memory you will see indicated on your screen is approximately 28K.

The good news is that the 3K expansion area is still there, provided you have a 3K cartridge plugged in, and it can be POKed and PEEKed in the same way as any other RAM locations. This makes it ideal for storing machine-code routines or similar, since Basic cannot overwrite it — no memory pointers to juggle, just 3,072 glorious bytes waiting to be used and a total free memory of approximately 31K despite what the screen tells you.

At this point you may be a little concerned at the thought of unprotected cartridges sitting up waiting to get knocked about, empty sockets yawning open for pins to be dropped into them, cables generally looking a little untidy. The answer? The optional metal cover. Quite why it is an option is puzzling, for it turns what is a fairly good expansion unit into an extremely versatile system. Put the cover on and you have the perfect stand for your TV; and if your TV is small enough, you can fit your cassette recorder on as well.

This is fortunate. You may remember that the modulator fits into the back of the expansion unit. This means that the lead from the Vic to the modulator has to be 'stored' inside the unit. It does, in fact, fit under the PCB, with a little coaxing; but now you only have the lead from the modulator to the TV which isn't all that long.

The fact is, this system lends itself to a portable TV. Even changing the cartridges is not a great hassle, with the cover lifting off easily once you have removed the telly.

Unlike the proposed Commodore motherboard, which will either plug into the expansion socket direct, or use a short ribbon cable connection, the Arfon unit enables you to carry the whole system around in one piece without the need to unplug any cartridges, sockets or cables, other than the TV and the mains lead. This will be a considerable advantage if the room in which you use your computer is not the room you keep it in normally — lounge and bedroom, for example. Constant plugging and unplugging will rapidly wear the edge connector on an expansion unit PCB, leading to trouble in the future. Since the Vic remains permanently connected in the Arfon unit no problems should arise from that source.

One final problem may occur if, like me, you want to be able to connect the Vic to the outside world via the user-port. The Arfon power supply to the Vic has already laid claim to this port with a rather thick twin flex. One way round the problem is to connect your own cable to the same plug and then to a suitable socket which you can mount easily on the side.

I have used this method with great success since

I no longer have to take the cover off to connect it: I plug the lead from the 'black box' into a DIN socket fitted into the side of the expansion unit and run the program.

This will not work if you have an external device which requires more than six connections, though or one which comes with its own user-port plug. In this case the only solution is to make or buy a 'splitter' lead with one plug connected by two cables to two user-port sockets. Although this would be rather a messy solution, the alternative of a plug-in board with one socket at the back and one on the side will not work here because there is insufficient room between the back of the Vic and the power supply box. Knowing the deviousness of some microcomputer users, however, I have no doubt that someone will come up with an elegant solution to this problem. In the meantime, if you really must have access to the user port you'll have to struggle on as best you can.

The Cost

The Commodore motherboard does not yet have a firm price announced, so comparisons on value for money are not possible. The Arfon unit sells for just under £100, including the optional cover, VAT and carriage.

Some may consider this expensive, since it does not include any extra memory or interface units. But it does open up a multitude of expansion possibilities for the Vic which are unobtainable without it. Personally, I rate it reasonable value for money, mainly because of the sheer versatility it offers.

Don't forget, there are going to be many more cartridges available in the future than there are now: and you are bound to want to use some of them, together with extra memory. This makes some form of expansion system a must for most people. Looking at the prices for other Commodore add-ons, the Arfon unit is probably going to be cheaper than Commodore's motherboard.

Conclusions

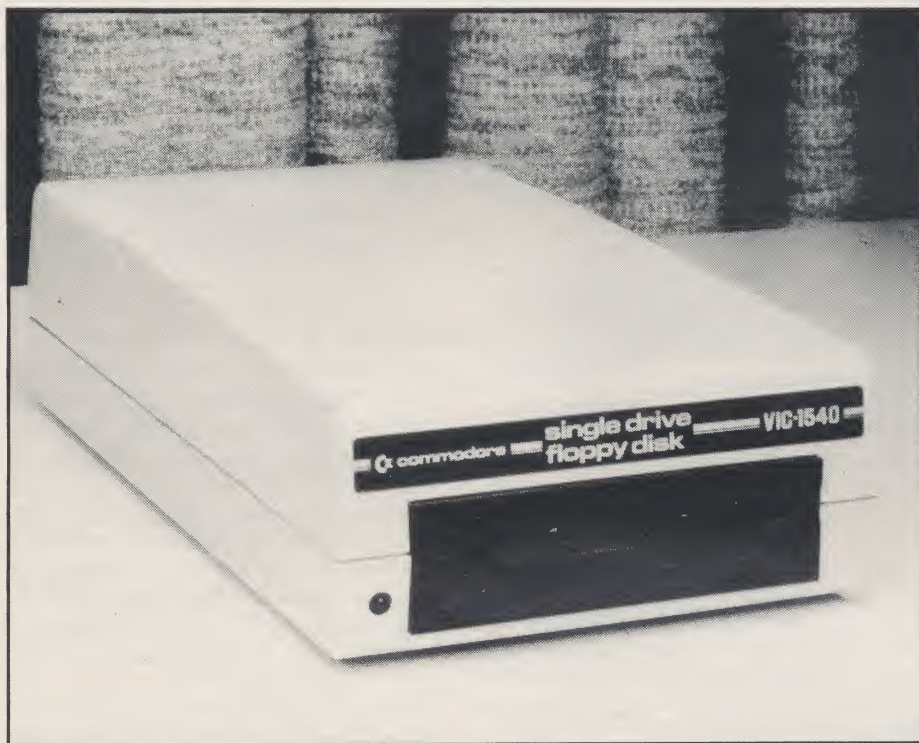
The Arfon expansion system is a well-built, robust unit which turns the basic Vic into a very versatile machine. Although the cover is an optional extra, the small additional cost (£8) is more than worth it for the extra versatility and protection. The on-board power supply is considerably superior to the original Vic transformer, and allows the mains to be switched off rather than merely the 9V supply.

The use of the user port to supply power to the Vic may cause problems in the future when trying to control other devices by means of the same port, unless someone produces a 'splitter' lead.

If you are going to be moving your Vic around a lot then this expansion system will save a considerable amount of wear on your expansion socket. At £100 it is not exactly cheap, but it does offer expansion possibilities that cannot be obtained in any other way.

Better ways to remember: two options in storing files

by Barrie Nicholson



Storing programs and data on converted audio cassettes is cheap, but it's awfully slow and very limited. You want more storage space and faster access? Barrie Nicholson looks at two faster and much more flexible alternatives to cassette — the digital cassette and the floppy disk. The rather special cassette unit comes from Currah Computer Components: the disk is Commodore's own VIC-1540.

The Vic-1540 floppy disk

Floppy disks go virtually hand in hand with microcomputers, and the arrival of the mighty micro effectively created the need for and subsequent development of floppies. In many ways they're the ideal mass storage peripheral for personal and small business computers. And now that Commodore's disk for the Vic is available, it opens up a host of applications.

The Vic-1540 comes in a neat enough box approximately 4in high by 8in wide and 14in deep (in matching cream plastic of course). In that you find one drive for 5.25in diskettes.

The Vic-1540 gives you about 170 kilobytes per disk.

These disks are pretty cheap — you should pay something between £1.50 and £2.50 for them,

depending where you buy. I get them by mail order in boxes of 10 at a cost of around £2 each, but dealers sell them in smaller quantities (albeit with more of a mark-up, and that can push the price per disk up to around £2.50).

Make no mistake about it, the disk drive itself is a complicated piece of equipment — and if you've got used to venting your neo-Luddite frustrations with the C2N cassette by banging it against the wall to make it work, you'd better get used to a more delicate approach.

For a kick-off the 1540 disk has in it about the same amount of electronics as the Vic itself. Inside the 1540 is the unit's own microprocessor, some memory, and ICs for handling the communications between it and the Vic (that's one of the really good things about the Vic, incidentally — all its peripherals have their own 'intelligent' electronic control, so the Vic itself doesn't have to waste too much time looking after them. Nor do they take up Vic's memory: they've all got their own). Then there's the disk drive itself, a piece of precision engineering; and the clever mechanics for positioning the read/write head.

And that lot all leads to a price tag of £396 — more than twice what you paid for the basic Vic, right?

But don't be too disheartened. If you have the

use for it, a disk is probably the most significant system peripheral you'll ever add to Vic. You get a lot of power for your money — and this particular drive compares well for price with the equivalents. The Atari for instance is a bit cheaper at about £345, but it gives you half the storage capacity.

Getting started

The 1540 is completely software-controlled, coming with its own disk operating system; and because disk operating systems are inevitably quite complicated, efficient use of it necessitates a fair amount of knowledge.

And that leads me to declare right now that we only got my hands on this drive a few days before the print deadlines, so I'm not an expert user. Nevertheless, I've familiarised myself with some of the basic commands and can give you an idea of performance; if after a bit more experience I can pass useful information on, I'll write Part II to this review.

First of all, the manual is terrible. It's full of misprints, for one thing. More important, it doesn't lead you gently and sensibly through the use of the drive in simple fashion — maybe the 'Getting acquainted with Vic' guidebook is a bit simplistic in tone, but it certainly sets quite a high standard by which the rest of Vic's documentation should be judged.

But with the disk booklet I disliked the style chosen to explain use of the commands, and there's a lack of clear examples — for instance, you are told more or less what kind of information will appear when you ask for a directory file listing: but there's no example screen and explanation to make it clear.

Another instance: the author slips uneasily between 'formatting' and 'initialisation', making it clear that there's a difference ('Do not confuse formatting and initialisation' cries page 19!) without actually making it clear what the difference is.

For those of you who already possess a Pet and one of its floppy disk systems, the drive itself and the DOS operating system will be all very simple. But that's tough on the rest of us. And for some reason Commodore has taken a user's manual that is already hard to follow and decreased in its size, stripping it of any helpful screen photos.

As to operation and performance, though, I have no real complaints there. You plug it into the serial port at the back of the Vic; if you have a printer in that already, you take it out and plug the printer into an extender port at the back of the disk. All nice and simple.

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There's an automatic self-test when you switch on, with a red LED that flashes if all isn't well. The manual says you've got troubles when that light keeps flashing, but in our case the way to stop it was simply to access a disk file — by reading the directory of the loaded disk, for example — and that seemed to cause no problems.

Using the disks wasn't hard, either, though some retries were necessary when we formatted. You have to format each disk you're going to use: that you do by OPENing a channel to the disk (it's device number 8) and using a PRINT # command. This will include a NEW statement — and no, it's got nothing at all to do with the NEW statement — and no, it's got nothing at all to do with the NEW command in Basic. So you might type:

```
PRINT # "NEW0: DISKONE,01"
```

That defines a new disk on drive 0 (you've only got drive 0, so it can be omitted) and names it as 'DISKONE' while assigning it a unique two-character identifier '01'.

It is of course daft that the command should be NEW. Actually it would be difficult to confuse it with a Basic NEW — unless you inadvertently omitted the PRINT # bit, and even then you'd be unlikely to have a live program sitting in memory while you are formatting disks. Still, it wouldn't have been difficult to find an alternative word.

Reformatting is a once-only job, but every time you load a disk for any reason you have to initialise it. Well, that's what the book says. In fact you don't really have to — it's a precaution to ensure that the BAM fits you disk.

What's a BAM, daddy? It's the Block Availability Map, a representation in the 1540's memory of what's on the disk. The BAM is the central part of the disk's operation: every time you SAVE a file, the BAM is consulted to decide whether it will fit and where physically it will be located on the disk.

Fair DOS

The DOS Disk Operating System gives you five new commands apart from NEW and INITIALISE. Of those, RENAME and SCRATCH are self-explanatory; and LOAD"\$" is the way you get at the directory (though loading it is all the command does — to actually see the directory you have to do a LIST as well).

The directory display gives you the name and identifier of the disk, as assigned by NEW. You also see the name, type and size of all files on the disk ('type' is defined by an OPEN command — see below — and 'size' is given in blocks, one block being 128 bytes). Finally there's an indication of the amount of space left.

The VALIDATE command is pretty smart. It's a housekeeper; it checks through everything on the disk, deleting files that haven't been properly closed and freeing any space located to a file but not being used. It's probably unnecessary for the usual sequential files, but it's essential for random access files — more of that later.

The COPY command is also clever, and it's really redundant for the current state of Vic's affairs. It enables you to replicate specific files, giving the copy a new name if you want: and as such it's there primarily to take back-ups from one drive to another. But you can also use it to concatenate up to four files into one new file with its own name. So you can set up standard routines and call them together with a command like this:

```
PRINT # 8, "COPY0: MYPROG = 0:  
SUBONE,0: SUBTWO: 0:SUBFIVE"
```

Incidentally, DOS commands can be abbreviated to a single letter — which is useful in this case, since command lines are restricted to a maximum of 40 characters; and file names can be quite long.

Eight Basic commands are available to get data to and from the disk. You LOAD and SAVE in the usual way, except that the filename is followed by the disk device number (as in LOAD "PROG",8). You can VERIFY something you've just saved.

For here on it gets more complicated, and the manual doesn't help. You OPEN and CLOSE logical files, and you have to do that for two sorts of file — the command channel (which you OPEN just as you do for a printer) and data channels (one per file you're working on).

An OPEN command specifies a logical file number, the device number, and possibly a secondary address; and it associates that lot with a file on disk, which it defines in terms of drive number (always 0), file name, file type, and mode.

The mode can be READ or WRITE: file type can be USR, SEQ, or PRG. USR seems to mean a user-specified format. A PRG file is a program, a SEQ is a sequential data file (a very simple cassette-type arrangement in which records can only be read in the order they were written and individual records cannot be altered and amended — all you can do is add new record on to the end of the file).

So a full-blown OPEN command might look like this:

```
OPEN 2,8,2"0:FILEX, SEQ, READ"
```

Some of that can be expressed as a variable, which helps:

```
FL$ = 0:FILEX, SEQ, READ"
```

```
OPEN 2,8,2FL$
```

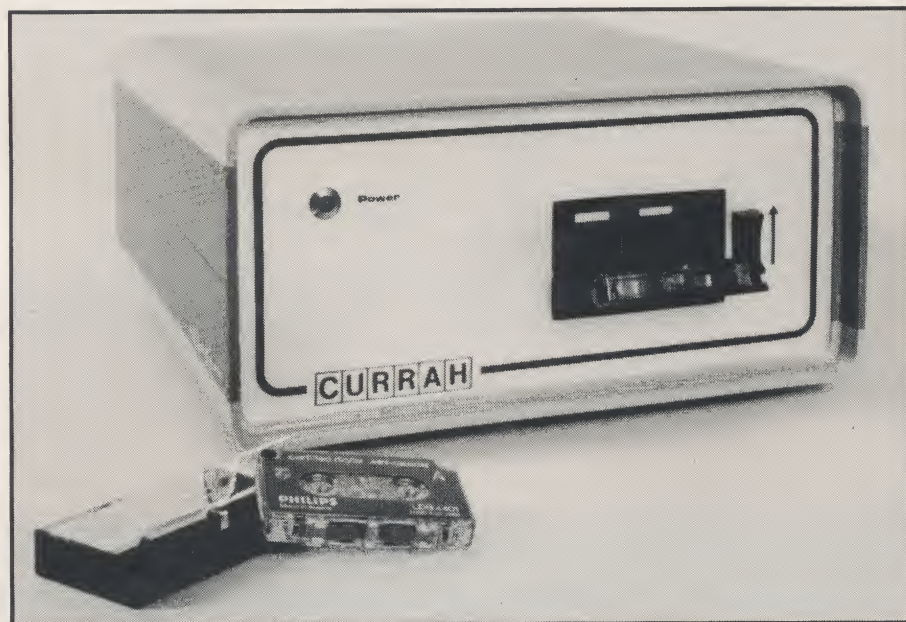
The other Basic commands are PRINT #, which transfers a command string to the drive (why 'PRINT'? I dunno); INPUT #, which picks up data items from the disk and assigns them to a variable; and GET #, which does a similar job for individual bytes of data.

There's a lot more to the DOS, and there's a section on advanced disk programming in the manual that shows you how to get directly to specific parts of the disk for true random access. Using such facilities there's another type of data file you can set up, and it's much more sophisticated: the random access file allows you to read and update individual records (just like on real computers).

Relatively speaking (since no one at Commodore UK could answer these questions) I'd say it's quite a slow drive in terms of getting information to and from the disk — I would estimate the access times at 500 milliseconds or so.

To the average punter, however, that's still extremely fast — well short of the sort of delay that gets you frustrated. Almost immediately after you ask for a file, it's started to load: and that goes for any file on the disk.

In view of that, the possible complaints about relative performance are somewhat emasculated. Superfast speeds are only useful if you can make use of them: you don't need a Ferrari to go down the road to Safeways, and you don't need a high-powered disk if you don't have the file volumes or the workloads to utilise it. Besides, the more modest performance obviously keeps down the price and/or improves the reliability.



DOS commands

These are all used with the PRINT # format

NEW	formats a disk
INITIALISE	maps disk to BAM
LOAD "\$"	reads disk directory
VALIDATE	tidies up the use of space on the disk
COPY	copies or concatenates a file
RENAME	renames a file
SCRATCH	deletes a file

With fast data transfer rates too (again I can't quote a figure), almost regardless of file length you do not wait long. As an example, a 3KB program takes some 10 seconds to save and 7 secs to read (save operations are slightly longer because of the housekeeping the DOS performs, updating the directory and the BAM).

Verdict

Commodore has elected to bring out just the single drive and shows no signs of developing a dual-disk unit. This makes does limit the potential of Vic somewhat: on disk-based computers it's common to have two drives, one disk holding operating system and applications software while the other has your files. It is also desirable to take frequent backup copies of your disks, and that's an extremely tedious operation with only one drive available at a time.

You can buy two units and connect them together if you want. That option isn't particularly cost-effective, but for the moment at least it's all you get.

The alternative is to buy a different computer, or wait for an enterprising firm to design their own add-on; in fact I hear a whisper that such a unit is on one UK company's drawing board at this moment — we'll keep you informed. That peripheral will be particularly valuable once 40-column Vics get on to the market.

In fact, the limitations of the Vic-20 do compromise disk use a little. For instance, if you've got more than a few programs on disk the directory won't fit on the screen — it scrolls up and you can't see the first names to appear. Nor can you get back to them with the cursor, of course. You can slow the process down somewhat by pressing the Control key, or you can play games by trying to list the directory only in part (it will treat the blocks-used/file information as if they were line numbers). But to get the full picture you do need to print them out.

One other criticism I have concerns the physical design of the drive. It is a fundamental law of human nature that flat surfaces inevitably become covered with paper or coffee cups or

both. Either way, the 1540's flat top plus cooling vents just has to be asking for trouble. Why not mount the disc vertically? Or put the ventilation slats in the slides?

On the whole, floppy disk systems are just about the best mass storage peripheral available for microcomputers: they make for quick and sophisticated access to stored information. The 1540 is neat, solid and looks pretty reliable. Though it appears is a little expensive by comparison with other Vic system components, it does open up applications areas for Vic that wouldn't really have been feasible using other recording media. If you want to dabble in those areas, you need a disk.

The Currah 220M Digital Cassette

Despite the name, digital cassette recorders bear little resemblance to the converted audio cassette player you're familiar with. Superior mechanics in the tape drive and better techniques of encoding information on the tape both help to give you much improved read/write speeds, increased reliability, and greater 'data integrity' (which means there's far less chance of errors when you read or write).

Digital cassettes come in a lot of different shapes and sizes (though so far this is the only one interfaced to Vic that I'm aware of) and they utilise a variety of recording techniques. But overall they can be regarded as a robust and reliable non-volatile mass storage peripheral sitting roughly midway between the ordinary cassette recorder and floppy disk in general price/performance terms.

For this review we got our hands on the 220M from Currah Computer Components (that's not a misprint, it's their name) of Hartlepool; it's an established machine, versions for other 6502-based microcomputers having been on the UK market for about a year.

It comes in a box about twice the size of a standard cassette player and it uses 'mini-cassettes' as the storage media. They're the kind of tapes you see in handheld dictation machines, measuring about 2x1 ins. Computer-grade versions of these are expensive, costing somewhere in the region of £19 per six-pack; but the 220M's encoding technique includes automatic error detection and correction, and that means it's quite feasible to use standard audio-grade tapes at about a pound each.

Either way the tape holds up to 64K bytes a side.

I say 'up to', because it can vary. Once you move to a more sophisticated storage peripheral there is often a degree of flexibility about the way data is stored on the media. The 220M can set up tapes to hold either variable-length program files (giving the 64KB maximum) or fixed-length data files (in which case you have up to 50K bytes per side).

Reading and writing is at 6,000 bits a second — that's about 20 times faster than the Commodore cassette. Tape winding is fast too, around 14 ips. Both are achieved by use of a hub drive motor (rather than the typical capstan and pinch roller you find in most cheap cassettes)

and the phase-encoding technique for holding data on the tape.

Phase encoding is a method which increases the reliability of read and write operations by combining a magnetic flux change with a synchronising pulse. The incidence of 'soft' errors (which means recoverable errors, such as a misread) for this system is quoted as 1 in 10,000,000; and if you want to complain about that, the overall reliability is increased even further by the data verification checks that the 220M automatically performs. After saving a program, for instance, it backspaces and runs an automatic check on the validity of what it's just read: if it comes across something it doesn't like you get an error notification.

One point to note is that the unit is completely software-controlled. That means there's no 'press the play button'. It comes with its own 21-command operating system, which is loaded after you type in one SYS command. After that you simply tell it what kind of files a tape will be holding, give the file a name, and the system software takes it from there setting up an appropriate 'directory' of files and formatting schemes. It has its own system memory and doesn't take up any of Vic's.

In the last issue of **Vic Computing** we said the 200M costs £195 ex VAT. That was right at the time; but a recent hefty price increase on the basic Philips drive units that Currah uses plus some fluctuations in the exchange rate (the drives come from Holland) has now pushed it up to £238 before VAT.

Extra commands

Currah's CTOS operating system gives you 21 extra Basic commands, identified by an @ prefix but otherwise looking much like the ordinary cassette commands.

Some of them are for tape management — tapes have to be formatted, for instance, and there's a handy fast-rewind command. Then there's a bunch of commands for 'house-keeping' — to open and close files, delete them, and manage the directory.

And then there are some real goodies, like @AP. This appends one Basic program on to the end of another, and that can be very handy if you want to set up a library of useful and frequently used subroutines. It's not omnipotent, though, and it won't sort out any conflicts in line numbering if you want to link one program to another.

Benchmarking

To get an idea of the unit's performance I taped 18 copies of a 3KB program on to one side of a minicassette — over 50K bytes worth of data in total.

Saving the first copy took around 22 seconds, saving the second clocked around 27. Each successive SAVE added five or six more seconds to the time, so by the time I saved the 18th copy it was taking some two minutes. This time includes an automatic rewind, however, and the operating system automatically updates the

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tape directory for you and gives you a screen listing of it (wouldn't you just love an automatic directory with the C2N?).

Loading is much quicker. After putting a tape in and reading the directory, one command loads the program you want. In my test, copy number 1 (right next to the directory) took something over three seconds; no. 9 (over 20KB into the tape) took 28 seconds; and no. 18 (about 50K down-tape) was timed at 57 seconds.

Three and a bit seconds per program gives (if you do your sums right) the 6,000 bits per second data transfer rate I mentioned earlier (ummm — 3K bytes divided by 3-point-something equals ... well, near enough).

Note that these load figures were all from a scratch start, from the directory at the beginning of the tape. When the desired program is found, the tape drive stays put there. Since the directory is held in RAM and is therefore always accessible, this means that when you're working with a tape full of programs the time taken to get to any one and then load it probably averages out at 20 to 30 seconds. The absolute worst case, having to get from one end of the 35 metre tape to the other, is 95 seconds — not bad compared to an audio cassette.

Loading my test program on a Commodore cassette takes around 40 seconds, and that's without any searching time taken into account.

Winding up

So if digital cassettes are so wonderful, why don't you see them all over the place?

Well, compared to a disk those timings are still slow. Digital cassettes have the fundamental limitation of any tape — data is held in one continuous stream rather than in almost randomly accessible blocks.

Neither is the operating system as sophisticated. For instance, if you delete a file stored on most disk systems, the contents of the disk are automatically rearranged to allow maximum utilisation of the space. When you kill a file on the 220M, you have to ensure the next program to be saved is equal in size or smaller than the old one as it tries to save it in the first available location.

Elsewhere on the minus side, there's from the recent £50 price increase; and £274 is depressingly close to the price Commodore wants for the 1540 disk.

Our other complaints are minor. There were a couple of bugs in the operating system, and the manual lacked a clear introduction to practical use; but then we're prepared to concede that we were getting a look at what was essentially a prototype system. The 220M hardware is tried and tested — some 400 machines are already in use in the UK by Pet, Ohio and Compukit owners — and the initial software problems simply reflect a lack of available knowledge of Vic's operating system on this side of the Atlantic. Currah says rewrites of the operating system and the manual should both be available by the time you read this.

A couple of other small minus points: the power cable was a lot shorter than Vic's, so the whole system had to be moved nearer the mains sockets. This may or may not aggravate you (and the Commodore disk also suffers from this penny-pinching). The Vic-to-220M connecting cable lacks any clear indications of the correct way round to insert it, which could have been solved with a couple of sticky labels; it is a bit floppy at the end which plugs into Vic's edge connector, too — there's no rigid plastic casing support like you get on a RAMPack.

The 220M provides the sort of high performance mass storage necessary for serious use of Vic in small businesses or education. It's not as good as a floppy disk, of course; but nevertheless it's fast enough for use in many similar applications — at about two-thirds the cost. What's more, in some cases (for example if Vic were used as an industrial controller in a harsh environment like a factory floor) it can be the more suitable choice.

A swift intro to the basics of computer storage

All computers need some kind of memory in order to function: being able to store and recall programs and information is one of the things that makes a computer a computer. Having said that, though, there's a wide range of storage technologies to choose from — with great variation in capacity, access time, and of course cost.

If Vic is your first brush with a computer, then you'll be most familiar with just two memory types: semiconductor and audio cassette. They sit at opposite ends of the cost/performance spectrum.

Semiconductor memory is what you get inside the Vic or in the expansion RAM packs — it comes in the form of chips plugged into a circuit board. It provides fast access to whatever's stored in there; but semiconductor memory is expensive, and usually it has the disadvantage of being 'volatile': it loses its contents when the power is turned off.

Because it's fast, semiconductor memory is used as the computer's working memory: you run your programs from it.

You'll want to store your newly created programs in the first place; and when you run your programs you may want to store the results too. For that you need non-volatility — and since it's likely you're going to have quite a lot of software and possibly big files, you'll need a large capacity as well. The usual media chosen for this is either tape or disk.

Tape — the slow but cheap option

When used with the converted audio cassette players that you're familiar with, magnetic tape storage has a lot going for it in terms of price. But technically it's nowhere.

It is slow — audio tones representing 1s or 0s are held in one-track serial form, so access times can be horrendous if you have to get at something which happens to be on the other end of the tape. Typical data transfer rates are only up to a few hundred bits per second (the Commodore unit runs at some 300 bps). And audio cassettes are prone to read and write errors.

But cassettes can store massive amounts of data, up to perhaps 500,000 bytes or so on one side of a C60 tape. And it's a sight better than using the older method of paper tape.

CTOS commands

@FO	formats a new tape
@BS	saves a file
@BL	loads a file
@DS	saves the directory
@PD	prints directory
@NF	new file
@OF	open file
@CF	close file
@VE	verify
@KF	delete file
@CD	close file and directory
@RE	read variable
@PR	print variable
@AP	append Basic program
@IR	initialise file pointer
@RW	rewind
@ER	erase tape
@RB	backspace one file
@RN	read next file
@WN	write next file

When you go up in price to a digital recorder, you get a different method of encoding data. That makes for a far more efficient tape unit. These recorders utilise better mechanics, such as hub drive or mechanically-linked capstans rather than the common capstan and pinch roller found in many home recorders; and they have encoding schemes which increase the bit density per unit-length of tape and improve the reliability of the read/write process.

There is one big problem that all tape systems share however; their serial nature. If the data you want is at the other end of the tape, it takes a long time to get there.

Disks — faster but expensive

Disk storage is the answer to that one. This stores data magnetically in bit-serial form on a number of sectors or blocks on concentric tracks. The read/write head can move across the surface to any one of those tracks; and the disk itself spins fast — anything from a few hundred to a few thousand RPM — so that to find any particular area takes only a few milliseconds.

Because of that extra technology, disks are more expensive than tape. They come in many different shapes and sizes, but broadly speaking in only two forms: hard or floppy.

Hard-disks have a rigid metal base and that gives them superior capabilities — very fast access time (under 100 milliseconds, say, and usually under 40ms) and storage capacities measured in megabytes (from 5MB upwards). Hard disks are the expensive ones, of course, and that means they're usually found on larger machines than Vic (though doubtless some enterprising individual will interface one sooner or later).

The kind of disk memory most commonly found on microcomputers, and the type we're interested in here, is the floppy disk. This has a flexible plastic base under its magnetisable coating. The original floppies measured 8in in diameter, and they're still around — you can get between 250KB and 3MB on one of them.

More recently developed is the smaller and much cheaper 5.25in floppy. This is capable of storing from 70KB or so to more than 1MB, depending on type, and it features access times measured in hundreds of milliseconds.

Three-lettered friends: how Vic can live with Pet

by Chris Preston



The Vic has been available for quite a while now, but the other Commodore machines have been around for a lot longer. There must be a large number of our readers who have one of those as well as a Vic — an 'old ROM' Pet, a 4000, one of the 8032s, maybe even the 96K SuperPet. Those of you who are so lucky might well be eager to get your favourite programs from your Pet on to your new micro: but it looks a daunting task, doesn't it?

Fear not, faint-hearted friends: stay tuned, and Chris Preston will reveal all (some mistake surely? Ed). **And don't look so dispirited converting between Pet and Vic really isn't too difficult at all.**

The task of taking a Pet program and getting it to run on a Vic can be broken down into two separate parts. First we have to physically move the program on to the new machine (preferably without having to key it in again!); then we have to alter the program to make it work. If the program is in Basic then this is quite easy. If the program was written in assembler, on the other hand, you may have a lot of work to do!

There are three possible ways to transfer data from a Pet to a Vic: cassette, disk or a direct communications link.

Using cassette The cassette format for Pet and Vic is exactly the same, so a Vic can read a Pet tape and vice versa without any problems.

Using disk First the bad news: the Vic disk, the 1540, has its own recording format, and it is

different from the formats used by any of the Pet drives. Now the good tidings: the 1540 format is **read-compatible** with 2040/3040/4040 disks. This means that you can read a 2040/3040/4040 disk on a 1540 disk drive, and you can read a 1540 disk on a 2040/3040/4040 unit. What you can't do is **write** to a disk of the other format. So you can load a program from your Pet disk, but then you will have to save it on to a properly formatted 1540 disk; you will not be able to save on to the Pet disk.

Unfortunately, there is no compatibility at all between the 1540 and the 8050. If you have an 8050, you will have to find another way of copying your programs across. Sorry!

Using a communications link There are already several manufacturers offering RS232 interfaces for the Vic; there are many such interfaces available on the Pet. But using this kind of direct link requires some programming, and the coding will depend very much upon which interfaces you are using; so we will not go into this method at all. If you already have the interfaces, feel free to try it: otherwise it would

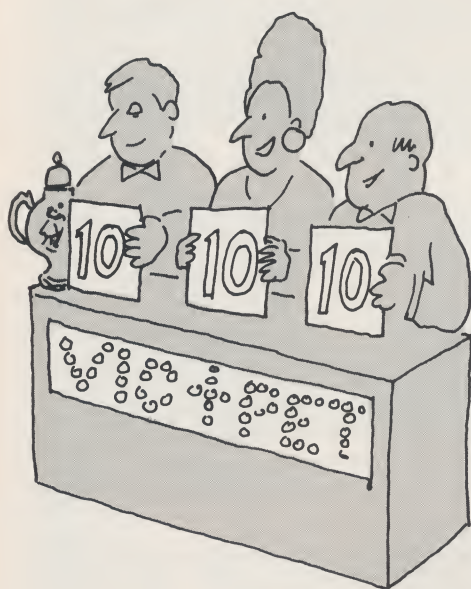
probably be best to use one of the two other methods.

Having got your program on to the Vic (or the Pet, if you are converting the opposite way) there still remains some work to be done.

The main differences between the two machines are memory usage by the program, Basic and the screen. The actual program format (tokens and such like) is the same for both. But zero page is different on the Vic, as are the ROMs. This means that any program which uses a lot of PEEKs and POKEs is going to be difficult to convert. There's a helpful but short memory map at the end of this article, but it is by no means comprehensive.

One interesting (infuriating?) feature of the Vic is the fact that the memory map changes when you add extra memory to it. This does not affect Basic programs unless they are PEEKing and POKEing, but assembler programmers will have to watch out. The addresses of the Basic program and screen area can be summed up like this:

Memory area	5k	8k	Over 8k
Start of Basic program	4096	1024	4608
Screen character RAM	7608 - 8186	7680 - 8186	4096 - 4602
Screen colour RAM	38400 - 38906	38400 - 38906	37888 - 38394



There is one small difference in the way in which a program is stored on disk or tape between the Pet and Vic. On the Pet, the file contains an address which determines whereabouts in memory the program will load. For Basic, this address is always 1025: but a machine code program could reside almost anywhere. The Vic keeps these bytes for compatibility, but they are not used. Instead, a program **always** loads at the address given in the table. This means that if you want a machine language program to sit at the top of memory, or in the tape buffer, you will have to write a routine to move it from the bottom of memory to wherever you want it. It will not load there automatically as on the Pet.

Of course the screen is a different size on the two machines, so all your PRINT statements will have to be altered. Any statements which POKE on to the screen will also have to be changed.

Covering Pet to Vic

This is probably the easier option of the two, because a Pet program will not have any sound or colour commands to worry about. You can always add them in later!

The only major change will be the screen size; the Vic screen is 23 lines of 22 characters, the Pet has 25 lines of either 40 or 80 characters.

The fact that the Basic program actually occupies a different place in memory does not matter — the Vic will always load it into the correct place, just like magic!

One thing you will have to check is that there is enough memory on your Vic to allow the program to load and run.

At risk of repeating myself, assembler programs, or Basic programs which contain large numbers of PEEKs and POKEs will be difficult to convert. You have been warned!

Converting Vic to Pet

Once again, any programming relating to the screen is going to be different. If you are using only PRINT statements, the program **will** run but the display will be squashed up in the left hand side of the screen. If you are using the colour and sound facilities of the Vic, these should be taken out before you try to run the program on the Pet.

Unlike the Vic the Pet expects its Basic programs to start at location 1024 — and unless you have an 8k Vic, the transferred programs will not start then. Fortunately it's not difficult to move the program down to its normal location. This is what you do:

you delete a line from a Basic program by keying a line number and pressing RETURN, a routine in the Basic interpreter moves all the lines after the one you have deleted to 'close up' the gap. We are making use of this routine to move our program down to the normal Basic area. Before we can delete a line though, we have to put one in to delete!

The two POKEs then join up the two parts of the program. At the start of each line in a Basic program there are two bytes which point to the start of the next line. We are setting these to point to the start of the Vic program up in the middle of memory.

When we delete the new line, Basic very kindly moves the program all the way down to its

5k	Over 8k
1. Load Program	1. Load Program
2. Enter a new line: 10 REM	2. Enter a new line: 10 REM
3. Enter these commands: POKE 1025,7 POKE 1026,16	3. Enter these commands: POKE 1025,7 POKE 1026,18
4. Delete line 10	4. Delete line 10
5. POKE 43, (PEEK(43)-12 CLR	5. SPOKE 43, (PEEK(43)-14 CLR

You must be very careful when you enter the new line 10 — the line must not contain any spaces, just the line number and REM. Don't worry if your program already has a line 10, or any lines numbered less than 10; in fact any line number can be used here. You must also resist the temptation to LIST the program until you have finished.

This procedure probably seems very mysterious. What does it do? Well, whenever

normal start address. The final box in the table just sets Basic's 'end of program' pointer correctly.

Vic	Pet	Contains
43-44	40-41	Basic start of program pointer
45-46	42-43	Basic end of program pointer
47-48	44-45	Basic end of variables pointer
49-50	46-47	Basic end of arrays pointer
55-56	52-53	Basic top of memory pointer
57-58	54-55	Basic current line number
97-102	94-99	Floating point accumulator
115	112	CHRGET subroutine
121	118	CHRGOT subroutine
122-123	119-120	Pointer to Basic program (TXTPTR)
152	174	Number of files open
198	158	Number of characters in keyboard queue
204	167	Cursor flash switch
209-210	196-197	Pointer to line containing cursor
211	198	Cursor column number

Here is the memory map we promised. It is not intended to be a fully comprehensive table, but it covers the more common locations used in Basic programs. The table contains no information as to using these locations. It should be used simply as a 'look-up' table: if your Pet program says POKE 174,0, your Vic program should say POKE 152,0. But if you have other, specific queries, feel free to write in to us.

Todd's Lore

by Mike Todd

There is a bug in the INPUT routine which can cause a whole line of characters to be returned instead of just those characters typed by the user. If you print characters beyond the end of a line, the Vic automatically puts the excess on the next line and makes a note that this new line is effectively part of the previous line. It is this wrap-around feature which allows a single line of Basic program text to actually consist of up to four screen lines. Unfortunately, the Vic fails to manage this correctly which results in any INPUT statement on a wrap-around line returning the entire contents of the line instead of the user INPUT.

This can occur if the INPUT prompt string takes you over the end of a line or you go for input on a previous wrap-around line. It does not occur on the first line of a wrap-around line.

I'm afraid that there is no easy solution other than making sure that you don't allow INPUT on a wrap-around line.

Now to a look at the peripheral chips — there are three of them, all in page \$90. The first is the Vic chip itself which I won't be looking at this time round.

The other two are 6522 VIA (standing for Versatile Interface Adapters). Each has 16 control/data registers, two timers, two input/output ports, a shift register and sundry interrupt and control ports. Without going into the detailed operation of these chips here, I have given the chip layouts for those who want to experiment further.

The first 6522 (VIA 1) starts at \$9110 (37136) and contains the RS232 port (doubling as the user port) on register B, with register A having lots of bits and pieces in it. The interrupt from VIA 1 is fed to the non maskable interrupt (NMI) which is used for the RESTORE key and RS232 control.

The two timers are used by the RS232 software; the first is the baud rate timer for RS232 receive and the second is for RS232 transmission. In fact what happens is that the RS232 data input line generates an interrupt as soon as a start pulse is received: thereafter it is the T1 timer which generates the interrupt. On each of these interrupts the RS232 data line is sampled and a complete RS232 byte assembled. Once a full byte has been received, T1 is disabled and the Vic awaits the next start pulse.

This is why the RS232 data input line appears in two places, once on the CB1 line (for start pulse detection) and the other on b0 of register B (to receive the data bit). The RESTORE key is also actioned via NMI.

VIA 2 (starting at \$9120 — 37152) has the keyboard row and column (register A and B) lines available (with two of the column output lines doubling as joystick and cassette lines). The VIA 2 interrupt line is fed to the normal interrupt line (IRQ) and is used for cassette input/output timing (using T2) and the normal 60Hz interrupt is generated by T1 timing out.

The full layout is shown in the diagrams. Note that for register C in both VIAs the three-bit controls (for CA2 and CB2) are set to 110 for the line to be set to 0, 111 for the line to be 1. Also, neither of the shift registers is actually used.

In my last column I mentioned that the SYS command allows the registers to be passed to it. There are many possible applications of this, but here are two simple ones.

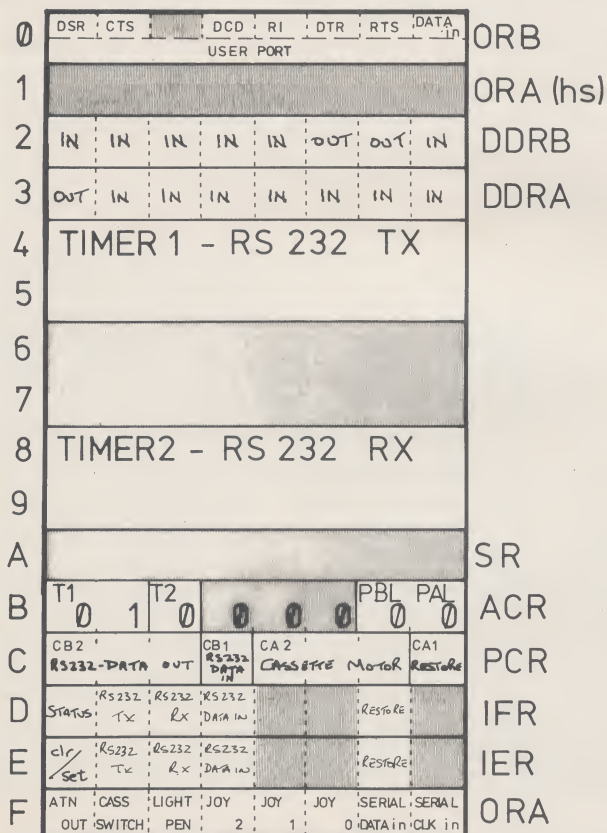
Some Basics allow cursor positioning at a specified point on the screen. You can do this on the Vic with:

POKE 781, line: POKE 782, position: SYS 65520

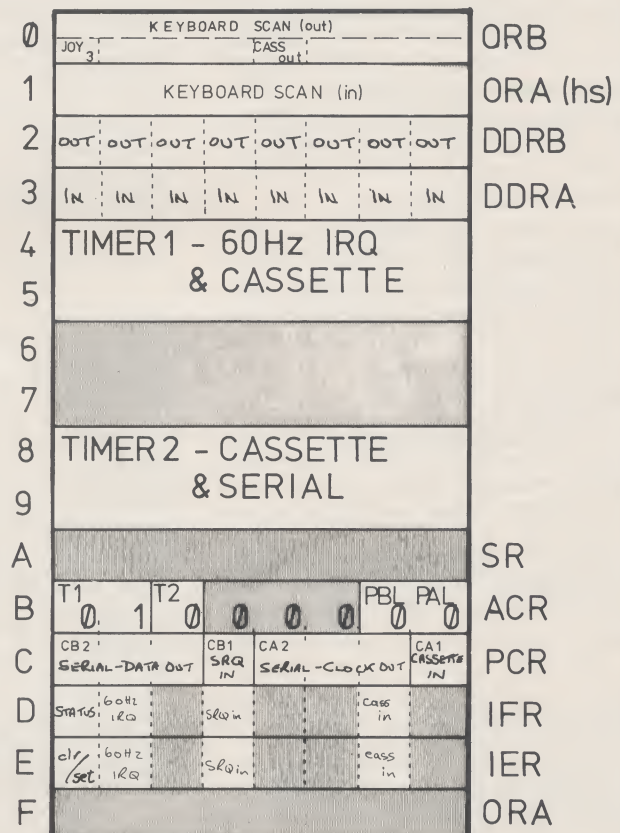
Similarly you can clear a whole line by:

POKE 781, line : SYS 60045

Also in my last column I mentioned that the function keys are only accessible using their



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ASCII values. Well, now that the Programmers Aid cartridge is available it is possible to assign any string to any function key so that when the key is pressed that string is entered just as though it had been typed in full.

Thus KEY 5, "RUN" + CHR\$(13) will result in the program being RUN when key 5 is pressed.

You may have read that the Vic uses a 6502A chip which can run at 2MHz — twice as fast as the Pet. Unfortunately some people have assumed that this means the Vic itself actually runs twice as fast as the Pet. Well, it doesn't. Let's see why.

At the heart of Vics and Pets is a crystal which provides clock pulses to allow the microprocessor, peripheral chips and the video to work correctly. On the Pet this is usually 16MHz, which is divided by 16 to get 1,000,000 clock pulses per second. This 1MHz clock is further divided to provide line and frame timing for the video circuitry: the latter is used as the 60MHz interrupt (for the TI clock).

On the Vic things are slightly different. The main constraint is that the VIC chip must have a clock input of 4.433618 MHz which is the frequency of the colour subcarrier in the British (PAL) TV system. If this were not accurate, TV sets just wouldn't be able to decode the colour information. This frequency is obtained by using a 8.876236 MHz crystal and dividing it by 2.

The VIC chip does all the necessary dividing from this clock to provide all the video signals. It also divides it by 4 to produce a 1.1084045 MHz clock for the rest of the VIC. Now it doesn't take much to realise that this clock is 11 per cent (or more accurately 10.84045 per cent) faster than the Pet's clock: and this is how much faster the Vic will run. The 6502A was chosen because the lower-speed 6502 would be unreliable at this higher clock frequency.

This clock system leads to two interesting features of the Vic. First, the 60Hz interrupt is no longer derived from the video frame pulses. Instead, one of the 6522 peripheral chips is used to divide the clock by 18470. This produces a TI clock which updates at a frequency of $1.1084045/18470 = 60.011072$ Hz. This means that the TI clock updates slightly more than 60 times a second and will in fact run .01845 per cent fast. The TI clock will be one second fast after 90 minutes 19 seconds.

One interesting feature of this method of deriving the 60Hz interrupt is that the interrupt rate can be changed very simply by two POKE commands which change this division ratio:

POKE 37156,LO : POKE 37157,HI

With HI=43 and LO=76 the division ratio is $43 \times 256 + 76 = 11084$ resulting in an interrupt every 1/100 second. Although TI\$ will no longer be correct, TI will now increment in hundredths of a second with an accuracy of 0.00041 per cent. Of course the keyboard

repeat and the cursor flash rate will be faster too. In fact you can try different values for HI

Finally, The Independent PET Users' Group (IPUG) has now been renamed The Independent Commodore Product Users' Group (ICPUG) to reflect the increasing range of Commodore products including the Vic.

Although the group is run on a national basis there are many regional groups under its wing and many have started, or are starting Vic user groups. As well as a regular newsletter (which also includes Vic material), there are group discounts on a range of products, access to the group's software library and access to the corporate expertise of a large number of Pet and Vic owners.

If you would like further details write to:

Jack Cohen,
ICPUG Membership Secretary,
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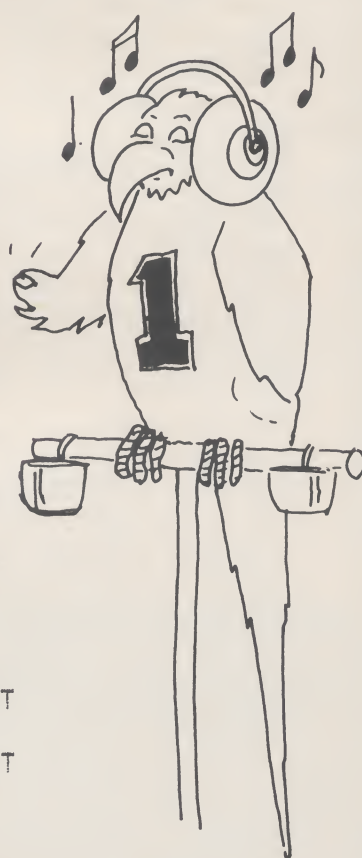
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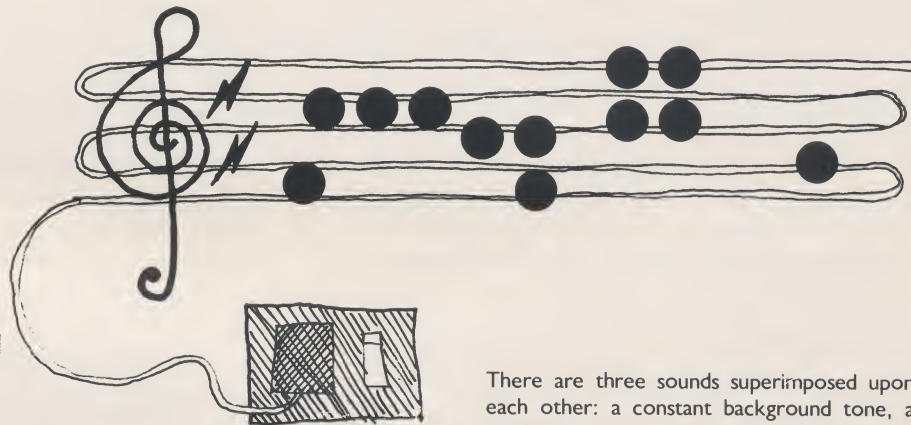
610 POKES2,225	1200 FORT=1T0500:NEXT	1740 POKES4,215	2330 FORT=1T02000:NEXT
620 POKES3,231	1210 POKES1,163	1750 FORT=1T050:NEXT	2340 POKES1,235
630 POKES1,135	1220 POKES2,237	1760 POKES4,0	2350 POKES2,191
640 FORT=1T0500:NEXT	1230 POKES3,232	1770 FORT=1T0450:NEXT	2360 POKES3,147
650 POKES2,235	1235 PRINT"NOTE	1780 POKES4,235	2370 FORT=1T01000:NEXT
660 POKES3,240	-COLOR STARTS"	1790 POKES1,147	2380 POKES1,135
670 FORT=1T0500:NEXT	1240 FORT=1T050:NEXT	1800 FORT=1T050:NEXT	2390 FORT=1T01000:NEXT
680 POKES1,175	1250 POKES1,0	1810 POKES4,0	2400 POKES2,175
690 POKES2,228	1260 FORT=1T0450:NEXT	1820 FORT=1T0450:NEXT	2410 FORT=1T01000:NEXT
700 POKES3,232	1270 POKES2,237	1830 POKES4,239	2420 POKES3,240
710 FORT=1T0500:NEXT	1280 POKES3,240	1840 POKES1,175	2430 FORT=1T01000:NEXT
720 POKES2,232	1290 FORT=1T0500:NEXT	1850 FORT=1T050:NEXT	2435 POKES3,225
730 POKES3,237	1300 POKES1,135	1860 POKES4,0	2440 POKES1,135
740 FORT=1T0500:NEXT	1310 POKES2,231	1870 FORT=1T0450:NEXT	2450 POKES2,159
750 POKES1,163	1320 POKES3,235	1880 POKES1,135	2470 FORT=1T01000:NEXT
760 POKES2,235	1330 FORT=1T050:NEXT	1890 POKES4,240	2480 POKES1,0
770 POKES3,228	1340 POKES1,0	1900 FORT=1T050:NEXT	2490 POKES2,0
780 FORT=1T0500:NEXT	1350 FORT=1T0450:NEXT	1910 POKES4,0	2500 POKES3,0
790 POKES1,159	1360 POKES2,235	1920 FORT=1T0450	2515 PRINT"NOTE ENDS
800 POKES2,225	1370 POKES3,240	1930 POKES1,135	3568 BYTES"
810 POKES3,235	1380 FORT=1T0500:NEXT	1940 POKES2,207	2517 FORT=1T03000:NEXT
820 FORT=1T0500:NEXT	1390 POKES1,175	1950 POKES3,235	2520 GOT05
830 POKES1,147	1400 POKES2,215	1960 FORT=1T050:NEXT	
840 POKES2,228	1410 POKES3,223	1970 POKES4,0	
850 POKES3,232	1420 FORT=1T050:NEXT	1975 PRINT"WHITE	
860 FORT=1T0500:NEXT	1430 POKES1,0	NOISE STOPS"	
870 POKES1,135	1440 FORT=1T0450:NEXT	1990 FORT=1T01500:NEXT	
880 POKES2,231	1450 POKES2,228	2000 POKES1,0	
890 POKES3,235	1460 POKES3,223	2010 POKES2,0	
900 FORT=1T0500:NEXT	1470 FORT=1T0500:NEXT	2020 POKES3,0	
910 POKES1,175	1480 POKES1,147	2040 POKES1,225	
920 POKES2,235	1490 POKES2,223	2050 FORT=1T0300:NEXT	
930 POKES3,239	1500 POKES3,228	2060 POKES1,228	
940 FORT=1T0500:NEXT	1510 FORT=1T050:NEXT	2070 FORT=1T0300:NEXT	
950 POKES2,228	1515 PRINT"NOTE	2080 POKES1,231	
960 POKES3,223	-COLOR ENDS"	2090 FORT=1T0300:NEXT	
970 FORT=1T0500:NEXT	1520 POKES1,0	2100 POKES1,232	
980 POKES1,201	1530 FORT=1T0450:NEXT	2110 FORT=1T0300:NEXT	
990 POKES2,239	1540 POKES2,235	2120 POKES1,233	
1000 POKES3,235	1550 POKES3,239	2130 FORT=1T0300:NEXT	
1010 FORT=1T0500:NEXT	1560 FORT=1T0500:NEXT	2140 POKES1,235	
1020 POKES2,223	1570 POKES1,175	2150 FORT=1T0300:NEXT	
1030 POKES3,215	1580 POKES2,223	2160 POKES1,237	
1040 FORT=1T0500:NEXT	1590 POKES3,228	2170 FORT=1T0300:NEXT	
1050 POKES1,195	1600 FORT=1T0500:NEXT	2180 POKES1,239	
1060 POKES2,237	1610 POKES2,0	2190 FORT=1T0300:NEXT	
1070 POKES3,233	1620 POKES3,0	2200 POKES1,135	
1080 FORT=1T0500:NEXT	1630 POKES1,135	2210 POKES2,225	
1090 POKES1,191	1640 PRINT"WHITE	2220 POKES3,235	
1100 POKES2,228	NOISE STARTS"	2230 FORT=1T02000:NEXT	
1110 POKES3,235	1650 POKES4,225	2240 POKES2,229	
1120 FORT=1T0500:NEXT	1660 FORT=1T050:NEXT	2250 FORT=1T02000:NEXT	
1130 POKES1,183	1670 POKES4,0	2260 POKES2,228	
1140 POKES2,228	1680 FORT=1T0450:NEXT	2270 POKES1,147	
1150 POKES3,232	1690 POKES4,235	2280 POKES3,175	
1160 FORT=1T0500:NEXT	1700 FORT=1T050:NEXT	2290 FORT=1T02000:NEXT	
1170 POKES1,175	1710 POKES4,0	2300 POKES1,232	
1180 POKES2,223	1720 FORT=1T0450:NEXT	2310 POKES2,228	
1190 POKES3,228	1730 POKES1,175	2320 POKES3,175	



```

1 PRINT"J"
2 LET Z=0
5 REM ELECTRONIC DISCO
10 PRINT"J"
20 FORA=1TO255
30 POKE36879,A
31 FORH=1TO2:PRINT"***ELECTRONIC DISCO***":NEXT H
32 LET Z=Z+1:IFZ>5THEN PRINT"J":IFZ>5THEN LET Z=0
35 LET X=INT(142+113)*RND(1)
40 FORN=245TO254
42 POKE36879,X
50 POKE36878,10
60 POKE36876,N
70 POKE36875,N
80 POKE36879,X
86 POKE36879,X
90 POKE36876,206
100 POKE36875,X
110 POKE36874,X
120 FORW=1TO50:NEXTW
125 NEXTN
126 POKE36879,N
130 FORS=254TO245STEP-1
140 POKE36876,X
150 POKE36875,S
160 POKE36874,X
300 FORT=254TO245
310 POKE36876,T
400 POKE36879,A+5
500 POKE36874,X
560 FORW=1TO35:NEXTW
600 NEXTS
990 NEXTA
999 GOTO10
20539;"P"
320 NEXT T
330 FOR M=1TO9000:NEXT W
340 GOTO 10
400 DATA "BP"
410 DATA 310
420 DATA 322,332,326,318,312,316,298,300,304
500 DATA "GEC"
510 DATA 752
520 DATA 760,781,782,808,814,829,800,806,830
600 DATA "P&O"
610 DATA 130
620 DATA 127,123,125,119,124,128,130,138,144
700 DATA "XXX"
999 END
14133 ,0,30,232,224,22,208,245,162,0,169,0,157,0,150,232,224,22
340 DATA208,248,76,191,234
350 PRINT"TIMSYS7525 TOSTART,7538 TO STOP!"
360 SYS7525
370 END

```



Electronic Disco

We hovered about including 'Electronic Disco' from James Clunie of Whitley Bay. It uses sound and colour to flash a display with electronic music, and frankly we didn't really like the results. Mind you, it's all a matter of taste: but the better electronic bands on offer right now might give you some rather more advanced ideas with which to adapt James' program. Try Kraftwerk or Heaven 17 for an inventory of the possible effects.

In the event we are publishing 'Electronic Disco' because it is a starting point for further development — and because it exhibits some nice uses of the POKE command. Here's a summary of them:

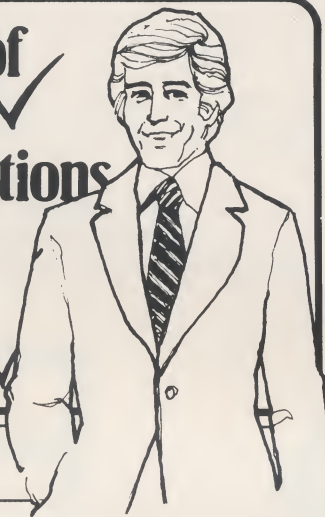
POKE 36874 . . . bass
POKE 36875 . . . tenor
POKE 36876 . . . treble
POKE 36878 . . . volume
POKE 36879 . . . colour

There are three sounds superimposed upon each other: a constant background tone, a random note that gives an element of difference, and a rising and falling set of high-pitched notes.

The colour is produced by superimposing two sets of colours. One is a random scheme of frames of different colours and backgrounds of different colours; the other is a constantly projected colour which causes the flashing of the screen at regular intervals.

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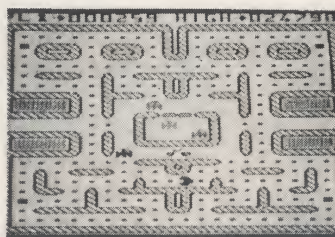
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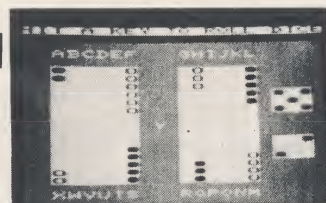
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10 PRINT "J"
50 D=0:O=7:P=5:Q=5:R=0:S=0:U=0:OO=5:PP=4:QQ=5:RR=0:SS=0:UU=0
55 A=5:AA=6:B=7:BB=8:C=9:CC=34
60 AB=48:AC=49:AD=48:AE=48
100 GOSUB5000
125 GOSUB1000
126 GOSUB9000
127 IFA=BANDB=CANDAA=BBANDBB=CCTHENAC=AC+3
128 IFA=BANDB=CANDAA=BBANDBB=CCTHEN150
129 IFA=BANDB=CCTHENAD=AD+5
130 IFA=BANDB=CCTHEN150
131 IFAA=BBANDBB=CCTHENAD=AD+5
132 IFAA=BBANDBB=CCTHEN150
133 IFA=BANDAA=BBTHENAD=AD+3
134 IFA=BANDAA=BBTHEN150
135 IFA=0ANDAA=65THENAD=AD+2
136 IFA=0ANDAA=65THEN150
137 IFA=0ANDAA=88THENAD=AD+2
138 IFA=0ANDAA=88THEN150
139 IFA=2ANDAA=83THENAD=AD+2:IFA=2ANDAA=83THEN150
140 IFA=2ANDAA=90THENAD=AD+2:IFA=2ANDAA=90THEN150
150 PRINT "#####HIT P TO PLAY"
152 GOSUB1000
155 GOSUB9000
160 GETS$:IFS$=""THEN160
165 IFS$="P"ANDAB=48ANDAC=48ANDAD=48ANDAE=48THEN10000
170 IFS$="P"THEN190
180 POKE36879,27:PRINT "E":END
190 AD=AD-1:PRINT "#####!"
195 GOSUB1000
200 GOSUB9000
250 D=INT(RND(1)*4):IFD=1THENGOSUB6000:PRINT "#####!"
251 PRINT "#####!"
260 GOTO 7000
269 D=0:O=7:P=5:Q=5:R=0:S=0:U=0:OO=5:PP=4:QQ=5:RR=0:SS=0:
UU=0
275 GOSUB1000
277 GOSUB9000
365 GOSUB1000
368 GOSUB9000
370 GOTO125
1000 IFAD<48THENAC=AC-1:IFAD<48THENAD=57
1010 IFAC<48THENAB=AB-1:IFAC<48THENAC=57
1020 IFAD>57THENAC=AC+1:IFAD>57THENAD=AD-10
1030 IFAC>57THENAB=AB+1:IFAC>57THENAC=AC-10
1040 RETURN
5000 POKE36879,106
5010 POKE8164,109:POKE8165,64:POKE8166,64:POKE8167,64:POKE8168,64:POKE8169,125
5020 POKE8142,93:POKE8120,93:POKE8098,112:POKE8147,93:POKE8125,93:POKE8103,110:P
OKE8102,64
5030 POKE8101,64:POKE8100,64:POKE8099,64:POKE8121,2:POKE8122,1:POKE8123,14:POKE8
124,11
5040 A=7681:POKEA,79:POKEA+1,99:POKEA+2,99:POKEA+3,99:POKEA+4,80
5050 POKEA+7,79:POKEA+8,99:POKEA+9,99:POKEA+10,99:POKEA+11,80
5060 A=7696:POKEA,79:POKEA+1,99:POKEA+2,99:POKEA+3,99:POKEA+4,80
5070 B=7703:POKEB,101:POKEB+4,103:POKEB+7,101:POKEB+11,103:POKEB+15,101:POKEB+19
,103
5080 C=7725:POKEC,101:POKEC+4,103:POKEC+7,101:POKEC+11,103:POKEC+15,101:POKEC+19
,103

```



Mr R. Martin of Grimsby sent us a bunch of short and neat games that should ensure his continued presence in our pages.

Here's a one-armed bandit complete with random hold and a drain on your pocket — the machine's takings go up by 10 on every play, and you only get 1000 to with. When the 'hold' appears, you must type Y or N for each box.

The program is based on random shapes and random colours. The jackpot is when you have the same shape and the same colour in all boxes: you win normally when the first two are identical, and when the three boxes have the same shape or the same colour. Minimal winnings accrue when the first box has a red heart or diamond or a black spade or club.

One-armed Bandit

5090 I=7747:POKED,101:POKED+4,103:POKED+7,101:POKED+11,103:POKED+15,101:POKED+19,103

5100 E=7788:POKEE,122:POKEE-1,100:POKEE-2,100:POKEE-3,100:POKEE-4,76

5110 POKEE-8,122:POKEE-9,100:POKEE-10,100:POKEE-11,100:POKEE-12,76

5120 POKEE-15,122:POKEE-16,100:POKEE-17,100:POKEE-18,100:POKEE-19,76

5130 POKE8143,AB:POKE8144,AC:POKE8145,AD:POKE8146,AE

5140 RETURN

6000 PRINT"#####HOLD###HOLD###HOLD"

6010 PRINT"#####HOLD Y PASS N"

6020 INPUT"#####";A\$

6030 INPUT"#####";B\$

6040 INPUT"#####";C\$

6045 PRINT"#####"

6050 IFA\$="Y"THENQ=1

6060 IFA\$="Y"THENR=A

6070 IFA\$="Y"THENQ0=1

6080 IFA\$="Y"THENRR=AA

6090 IFB\$="Y"THENP=1

6100 IFB\$="Y"THENS=B

6110 IFB\$="Y"THENPP=1

6120 IFB\$="Y"THENS=BB

6130 IFC\$="Y"THENQ=1

6140 IFC\$="Y"THENU=C

6150 IFC\$="Y"THENQ0=1

6160 IFC\$="Y"THENUU=CC

6170 IFA\$="N"THENQ=7

6180 IFA\$="N"THENR=0

6190 IFA\$="N"THENQ0=5

6200 IFA\$="N"THENRR=0

6210 IFB\$="N"THENP=5

6220 IFB\$="N"THENS=0

6230 IFB\$="N"THENPP=4

6240 IFB\$="N"THENS=0

6250 IFC\$="N"THENQ=5

6260 IFC\$="N"THENU=0

6270 IFC\$="N"THENQ0=5

6280 IFC\$="N"THENUU=0

6290 RETURN

7000 X=0

7010 IFX=15THEN7110

7020 A=INT(RND(1)*0)+R

7030 IFA=6THENA=7

7040 AA=INT(RND(1)*00)+RR

7050 IFAA=0THENA=65

7060 IFAA=1THENA=83

7070 IFAA=2THENA=88

7080 IFAA=3THENA=90

7085 IFAA=4THENA=81

7090 POKE38446,A:POKE38447,A:POKE7726,

AA:POKE7727,AA:POKE7728,AA:POKE38448,A

7100 FORT=1T020:NEXTT:X=X+1:GOTO7010

7110 X=0

7120 IFX=10THEN7220

7130 B=INT(RND(1)*P)+S

7140 IFB=3THENB=5

7150 BB=INT(RND(1)*PP)+SS

7160 IFBB=0THENBB=65

7170 IFBB=1THENBB=83

7180 IFBB=2THENBB=88



7190 IFBB=3THENBB=90

7200 POKE7733,BB:POKE38453,B:POKE7734,BB:POKE38454,B:POKE7735,BB:POKE38455,B

7210 FORT=1T020:NEXTT:X=X+1:GOTO7120

7220 X=0

7230 IFX=6THEN269

7240 C=INT(RND(1)*0)+U

7250 CC=INT(RND(1)*00)+UU

7260 IFC=3THENC=5

7270 IFCC=0THENC=65

7280 IFCC=1THENC=83

7290 IFCC=2THENC=88

7300 IFCC=3THENC=90

7305 IFCC=4THENC=81

7310 POKE7741,CC:POKE38461,C:POKE7742,CC:POKE38462,C:POKE7743,CC:POKE38463,C

7320 FORT=1T020:NEXTT:X=X+1:GOTO7230

9000 POKE8143,AB:POKE8144,AC:POKE8145,AD:POKE8146,AE:RETURN

10000 PRINT"J":POKE36879,42:PRINT"#####BROKE"

10010 POKE36878,15:POKE36876,245

21399 1,135:POKE82,175:POKE83,221

7001 FORL=240T0135STEP-5

7002 POKES3,L

7003 FORM=1T020

7004 NEXTM

7005 NEXTL

7012 FORT=1T0125:NEXT

7013 POKES4,235

7014 FORT=1T0500:NEXT

7015 POKES1,0:POKES2,0:POKES3,0:POKES4,0

7016 FORT=1T01500:NEXT

7020 GOTO100

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Here's another neat little contribution from R. W. Moore of Sutton Coldfield. This program is a simple example of interrupting the interrupt routine to enable tasks to be performed independently of other activities of the micro-computer.

In this case, a message will be displayed on the top line of the screen; it cannot be cleared or

corrupted by other programs. The message can range from "Fred's Computer" to a reminder such as "watch News at 10 tonight".

Line 50 clears the top line of the screen and POKEs zero (for black) into the colour register. Line 60 lowers the top of memory from 7680 to 7524 (156 bytes) to accommodate the machine code program. (Locations 55 and 56 in memory point to the low byte and the high byte of top of memory. On the unexpanded Vic-20 these locations contain 0 and 30, giving the top of memory as $0 + (30 \times 256) = 7680$. Line 60 changes these values to 100 and 29 respectively, giving top of memory as $100 + (29 \times 256) = 7524$.)

Line 80 requests the message and line 110 looks for a carriage return — CHR\$(13). If it finds one the program jumps to line 170. Line 120 detects a key press (location 203 holds 255 if no key is down) and counts the number to a two-part form for poking to the top of the screen in line 150.

Line 160 constructs a composite string from the individual key entries. Line 180 checks that the string is not too long and if it is resets the number of characters to zero and starts again.

Lines 190-250 look at each character in turn in the string, converts to the poke form and pokes them into a specific memory area. Lines 260-280 read and poke in the machine code program, while lines 290-300 put the string length into the appropriate place in the machine code program.

Line 310 contains the decimal equivalent of the machine code instructions to set the interrupt and to revector the interrupt address in locations 788 and 789 to the machine code routine in line 3130.

Line 320 resets the whole machine (equally well done by pressing STOP and RESTORE). Line 330 is the program proper which transfers each letter of the message to the top of the screen and also puts zero into the corresponding colour matrix positions to give black letters.

Task Interrupt

```

10 REM INMESS
15 REM RWM 1982
20 REM PRINTS MESSAGE ON TOP OF SCREEN
30 REM START 8487525
40 REM STOP 8487539
50 PRINT "0":FORK=38400TO38443:POKEK,0:NEXT:FORL=7524TO7529+22:POKEU,32:NEXT
60 DIMD(34):POKE55,100:POKE56,29
70 X=0:Y=0:Z=0:A$=""
80 PRINT"ENTER MESSAGE.END WITH RETURN"
90 PRINT"UP TO 22 CHARACTERS"
100 GETC$:IFC$=""THEN100
110 IFC$=CHR$(13)THEN170
120 IF PEEK(203)>255THENX=X+1
130 IFX=10THENX=0:Y=Y+1
140 Z=Y+48:IFY=0THENZ=32
150 POKE7721,Z:POKE7722,X+48
160 PRINTC$:A$=A$+C$:GOTO100
170 PRINT
180 IFLEN(A$)>22THENPRINT"TOO LONG!":POKE7721,32:POKE7722,08:GOTO80
190 FORJ=1TOLEN(A$)
200 B$=MID$(A$,J,1)
210 B=ASC(B$)
220 IFB<63THENVC=B
230 IFB>63THENVC=B-64
240 POKE7578+J,C
250 NEXTJ
260 FORI=1TO54
270 READD
280 POKE7524+I,D:NEXT
290 Q=LEN(A$)
300 POKE7561,Q
310 DATA120,169,127,141,20,3,169,29,141,21,3,98,96
320 DATA120,169,191,141,20,3,169,234,141,21,3,98,96
330 DATA152,0,199,155,29,157,0,09,232,224,22,208,245,162,0,169,0,157,0,158,232,2
340 DATA208,248,76,191,234
350 PRINT"8487525 TO START,7538 TO STOP:"
360 8487525
370 END

```

CHASER

```

10 REM CHASE
20 GOSUB 9000
30 CT=7680:TC=38400:CP=65:EP=42:KM=197:CX=0:CY=22:KI=0
40 POKE36879,232
50 PRINT"***** CHASER *****"
60 PRINT"TIME:*****HI -";HI;" ";
70 FORI=1TO20
80 FORJ=0TO21
90 POKECT+44+(I*22)+J,160
100 POKECT+44+(I*22)+J,INT(RND(1)*7)
110 NEXT:J=0
120 FORI=1TOINT(RND(1)*75)
130 POKECT+INT(RND(1)*21)+(INT(RND(1)*22+3)*22),86
140 NEXT
150 POKECT+462,160:POKECT+463,160:POKECT+485,160:POKECT
+484,160
160 FORI=1TO5
170 CX(I)=INT(RND(1)*21)
180 CY(I)=INT(RND(1)*22):IFCY(I)<3THEN180
190 POKECT+CX(I)+(CY(I)*22),EP:NEXT
200 POKE7767,81:POKE38487,6
210 NT=TI
250 GOSUB1000
260 OP=CX+(22*CY)
270 SC=SC+1
280 POKE36874,241
290 KP=PEEK(KM)
300 IFKP=48THENCY=CY-1
310 IFKP=9THENCY=CY+1
320 IFKP=14THENCX=CX-1
330 IFKP=54THENCX=CX+1
340 IFCX<0THENCX=0
350 IFCX>21THENCX=21
360 IFCY<3THENCY=3
370 IFCY>22THENCY=22
380 IFCY=3ANDCX=21THEN4000
390 IFSC/2<>INT(SC/2)THEN900
400 FORI=1TO5
410 POKE36876,130
420 POKE36874,0
430 IFCX(I)=999THEN520
440 POKECT+CX(I)+(CY(I)*22),160
450 IFCX(I)<CXTHENCX(I)=CX(I)+1
460 IFCX(I)>CXTHENCX(I)=CX(I)-1
470 IFCY(I)>CYTHENCY(I)=CY(I)-1
480 IFCY(I)<CYTHENCY(I)=CY(I)+1
490 POKECT+CX(I)+(CY(I)*22),EP
500 IFCX(I)=CXANDCY(I)=CYTHEN3000
510 GOSUB1000
520 POKE36876,0
530 NEXT
900 IFPEEK(CT+CX+(CY*22))=86THEN5000
910 POKECT+OP,160:POKECT+OP,PC
920 POKECT+CX+(22*CY),CP
930 PC=PEEK(TC+CX+(CY*22))
940 POKECT+CX+(CY*22),0
950 POKE36874,0
960 GOTO 250
1000 NX=TI-NT

```

```

1010 NX=NX/60
1020 NX=INT(NX*10)/10
1030 PRINT"*****";NX;
1040 RETURN
3000 REM
3010 KI=KI+1:CX(I)=999:IFKI<2THEN520
3020 POKECT+OP,160:POKECT+CX+(CY*22),87
3030 POKE36877,220
3040 FORL=15TO0STEP-1
3050 POKE36878,L:POKE36879,7+L:
POKECT+CX+(CY*22),INT(L/2)
3055 FORM=1TO300:NEXT
3060 NEXT

```

'Chaser' from Jonathon Hiscox of Middlesborough is a long program, but it's quite clever. The screen fills up with randomly-coloured squares, and you have to pick your way across them from a bottom-left start to a home position at the top right.

You think that's easy? For a start you're trying to do it as quickly as possible (there's a clock ticking away in the corner). Then there are stationary obstacles to avoid; hit one and you get electrocuted. And the reason you might hit one, apart from your carelessness, is the presence of highly mobile aliens that will pursue you. They catch you and you've had it: the screen gives you a time count and a sarcastic message.

The game is difficult but possible. The instructions are in the program, which is great, and the sound effects are pretty good too.



```

3070 POKE36877,0:POKE36879,237
3100 PRINT"JIMMY WELL THEY FINALLY GOT"
3110 PRINT"TO YOU, AND IT TOOK"
3120 PRINT"ALL OF ";NX;" SECONDS"
3130 PRINT"TO DO IT!!"
3140 POKE36879,232
3150 GOTO10000
4000 REM
4010 PRINT"J":POKE36879,24
4020 POKE36874,0:FORI=0TO22
4030 POKE36864,12+I
4040 POKE36865,38+I
4050 POKE36866,150-I
4060 POKE36867,174-I*2
4070 POKE36877,230+I
4080 NEXT
4090 FORI=22TO0STEP-1
4100 POKE36864,12+I
4110 POKE36865,38+I
4120 POKE36866,150-I
4130 POKE36867,174-I*2
4140 POKE36877,230+I
4150 NEXT
4160 POKE36877,0
4170 PRINT"XXXXXXXXXXWELL DONE J- MIT TOOK"
4180 PRINT"XXXXXXXX";NX;" SECONDS"
4190 IFHI>0THEN4230
4200 PRINT"XXXXTHE FIRST TO SUCCEED"
4210 HI=NX
4220 GOTO4280
4230 IFHI>NXTHEN4260
4240 PRINT"XXXXHARD LUCK - NOT FAST ENOUGH"
4250 GOTO4280
4260 PRINT"XXXX - THE FASTEST YET!"

```



```

4270 HI=NX
4280 FORDE=1TO3500:NEXT
4290 GOTO10
5000 REM
5010 POKE36874,0:POKECT+OP,160
5020 FORL=0TO6:POKETC+CX+(CY*22),L
5030 FORM=180TO235STEP2
5040 POKE36876,M
5050 FORN=1TO10:NEXT
5060 NEXT
5070 FORM=1TO100:NEXT
5080 NEXT
5090 POKE36878,0
5100 PRINT"JIMMY WELL, AT LEAST YOU "
5110 FORM=1TO100:NEXT
5120 PRINT"WEREN'T CAUGHT BY THE"
5130 PRINT"ALIENS - YOU HAD TO"
5140 PRINT"BE DIFFERENT, AND GET"
5150 PRINT"YOURSELF ELECTROCUTED"
5160 GOTO10000
9000 REM
9010 POKE36876,0
9020 POKE36878,15
9030 PRINT"JIM"
9035 POKE36876,0
9040 PRINT"CHASER"
9050 PRINT:PRINT"YOU START AT THE LOWER";
9060 PRINT"LEFT CORNER OF THE"
9070 PRINT"SCREEN, AND YOU MUST"
9080 PRINT"REACH THE TIME TUNNEL"
9090 PRINT"AT THE TOP RIGHT OF "
9100 PRINT"THE SCREEN - EASY HUH?"
9110 PRINT"BUT YOU MUST AVOID THE";
9120 PRINT"OBSTACLES (X), AND THE";
9130 PRINT"ALIENS (*) THAT WILL"
9140 PRINT"FOLLOW YOU, AND IF TWO";
9150 PRINT"GET YOU, YOU'VE HAD IT";
9160 PRINT:PRINT"IF YOU HIT ONE OF THE"
9170 PRINT"STATIONARY OBSTACLES"
9180 PRINT"YOU GET ELECTROCUTED"
9190 PRINT"WHIT [F1]"
9200 GETZ$:IFZ$<>" "THEN9200
9210 PRINT"XXXXXXXXXX[Q] UP"
9230 PRINT"XXXXXXXXXX[W] DOWN"
9240 PRINT"XXXXXXXXXX[*] LEFT"
9250 PRINT"XXXXXXXXXX[↑] RIGHT"
9260 PRINT"WHIT [F1]"
9270 GETZ$:IFZ$<>" "THEN9270
9900 RETURN
10000 REM
10010 PRINT"JIMMY WELL, DO YOU GIVE UP,"
10020 PRINT"OR ARE YOU AS STUBORN"
10030 PRINT"AS A MULE ??"
10040 PRINT"GO ON, WILL YOU TRY AGAIN ?";
10050 GETZ$:IFZ$=""THEN10050
10060 IFZ$="Y"THEN10
10070 IFZ$<>"N"THEN10050

```

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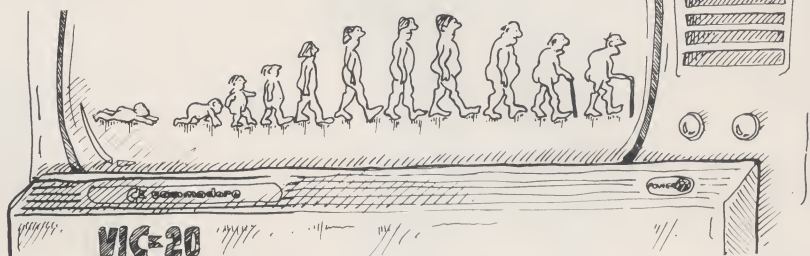
Victrials

```

1 REM RWM 1982 LIFE
10 DIMK(10,10):DIMB(10,10):DIMC(10,10)
20 G=0:R=RND(-1):H=0:T=30720:Z=0:PRINT"J"
30 FORX=2TO9
40 FORY=2TO9
50 IFRND(1)<.45THENA(X,Y)=1
60 B(X,Y)=R(X,Y)
70 NEXTY
80 NEXTX
90 GOSUB1000
95 G=G+1
100 FORX=2TO9
110 FORY=2TO9
120 C=0:Z=0
125 K(X,Y)=A(X,Y)
130 IFA(X-1,Y-1)=1THENC=C+1
140 IFA(X-1,Y)=1THENC=C+1
150 IFA(X-1,Y+1)=1THENC=C+1
160 IFA(X,Y-1)=1THENC=C+1
170 IFA(X,Y+1)=1THENC=C+1
180 IFA(X+1,Y-1)=1THENC=C+1
190 IFA(X+1,Y)=1THENC=C+1
200 IFA(X+1,Y+1)=1THENC=C+1
210 IFA(X,Y)=1ANDC<3ANDC>2THENB(X,Y)=0
220 IFA(X,Y)=0ANDC=3THENB(X,Y)=1
230 NEXTY
240 NEXTX
250 Z=0:GOTO290
1000 PRINT"###    GENERATION":G:W=0:Z=0
1004 S=7861
1010 FORX=1TO10
1020 FORY=1TO10
1025 IFK(X,Y)=B(X,Y)THENZ=Z+1
1030 A(X,Y)=B(X,Y)
1035 ZZ=7838+X+22*Y
1040 IFA(X,Y)=1THENPOKEZZ,15:POKEZZ+30720,0:W=W+1
1050 IFA(X,Y)=0THENPOKEZZ,32:POKEZZ+30720,0
1055 POKE8,79:POKE8+9,80
1057 POKE8+199,76:POKE8+207,122
1058 POKE8+T,0:POKE8+9+T,0
1059 POKE8+T+199,0:POKE8+T+207,0
1060 NEXTY:NEXTX
1066 IFZ=100ANDW>0THENPRINT"###STABLE COLONY AFTER":G-1:"GENERATIONS":GOTO1100
1070 IFW=0THENPRINT"###COLONY DEAD AFTER":G-1:"GENERATIONS":GOTO1100
1075 IFG<10THENPOKE7717,G+176
1076 IFG>9THENG1=INT(G/10):G2=G-G1*10:POKE7717,G1+176:POKE7718,G2+176
1077 IFW<10THENPOKE8152,W+48:POKE8152+T,0:POKE8151,32:POKE8151+T,0
1078 IFW>9THENW1=INT(W/10):W2=W-INT(W/10)*10
1079 IFW>9THENPOKE8152,W2+48:POKE8152+T,0:POKE8151,W1+48:POKE8151+T,0
1080 RETURN
1100 PRINT"###    AGAIN/Y OR N?"
1110 GETJ$:IFJ$=""THEN1110
1120 IFJ$="Y"THEN20
1130 IFJ$="N"THENEND

```

LIFE!



Every computer should have a version of 'Life', the well-known computer simulation of the birth and death of a colony of cells. R. W. Moore of Sutton Coldfield has duly obliged for the Vic. The show starts with a random set of 30 cells seeded into a 10x10 matrix. At each new generation a cell adjacent to two or three neighbours survives and in each blank space with three neighbours a new cell is born.

Most of the time the cell colony will die off after a number of generations; but occasionally a stable configuration is achieved and the colony neither grows nor shrinks. Each repetition of the cycle starts with a completely new pattern of seed cells. It's really hypnotic watching it happen!

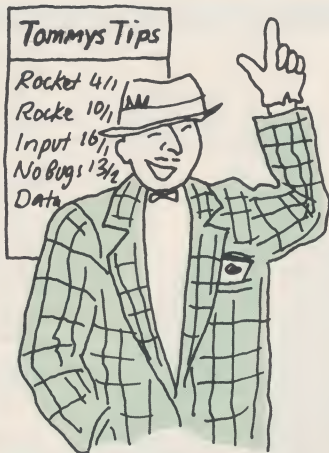
Line 10 of the program dimensions three arrays and lines 20 to 80 set up the initial colony. Subroutine 1000 counts the number of positions identical with those in the preceding generation and POKEs the spaces and cells on to the screen.

As printed the program is in black and white, but altering the second command on line 1040 will at least change the colour of the cell. For example, POKE zz+30720,2 will give red symbols for the cells.

Lines 1056-1059 construct the frame outline of the colony. Again, it's in black and white: changing all the POKE S+T statements will give a coloured frame.

Lines 95 to 240 handle the birth-death logic and lines 1100-1130 enable the complete sequence to be restarted.

Tommy's Tips



Welcome to the first edition of Tommy's Tips à la Vic. "Hi" to all my old friends from **Microcomputer Printout** magazine and "pleased to meet you" to all my new readers. I am very excited at my new job here, lots of new things to do with the new machine!

Before we get down to some technical questions, can I make a plea which will be very familiar to **Printout** freaks: **Please write to me!** My job is to solve problems, but I cannot answer queries I do not know about. So don't be afraid, put pen to paper and let me know that somebody out there is reading my column.

One immediate difference between the pile of letters I get at **Vic Computing** and **Printout** is the large number of foreign readers. Obviously **Vic Computing** is widely read in Europe, so maybe I am going to have to add French and German to the computer languages I need to learn!

One common query which is cropping up again and again already comes from readers who wish to sell programs they have written and want to know how to copyright them. It is very easy to copyright a program, you just write **COPYRIGHT** all over it! Unfortunately it is impossible to enforce the copyright because in no country in the world has the law caught up with the pace of computer development. It is difficult enough to stop people copying records and audio cassettes, let alone much more expensive programs.

As regards selling programs, there are several companies who specialise in selling other peoples' software and paying them royalties.

For example there is Commodore itself, and ACT (Microsoft) sells programs too (you can reach them on 021-454 8585). One thing you must remember is that the standard required for commercial software is very high indeed — nowadays there are many professional programmers writing software for the home computer market. But if you have written a good program which has good presentation plus mass appeal and **no bugs**, there is no reason why you should not try to sell it. Also remember that any money you earn is subject to tax — it is not worth

trying to fiddle it.

After all that waffle, how about some queries then?

Dear Tommy, I would be very grateful if you could tell me where the interrupt vector on the Vic-20 is located.

The interrupt vector is to be found in locations \$314 and \$315. By the time the processor reaches this vector, the processor registers have already been stacked. So you should end your interrupt routine with the following code:

PLA	TAX
TAY	PLA
PLA	RTI

Dear Tommy, I saved a file with the name ROCKET2. Subsequently I have found that I can cause the file to be loaded by any of the following commands:

LOAD "ROCKET"
LOAD "ROC"
LOAD "R"

This is not peculiar to my system. My local Commodore dealer experienced it on his when I sought an answer from him. There is no Vic documentation relating to the phenomenon.

I am surprised that your Commodore dealer could not explain this to you. This is a feature of all Commodore cassette operating systems, going back through all the Pets to the year dot. Any cassette file can be identified by the leading characters of the filename; in your example **ROCKET**, **ROCKE**, **ROCK**, and so on. This is tucked away in an obscure corner of the Pet manuals, but as you say, it is not to be found in the Vic documentation. There is unfortunately nothing you can do about it except bear it in mind when you are saving more than one file on a tape. If you take advantage of the feature though, it can save you a lot of typing!

Dear Tommy, I have recently acquired a Vic and I am thoroughly satisfied with it. However, on reading advertisements I discover that the Vic is capable of high-resolution graphics without the

added high-resolution pack; but on reading my manual I can find no mention of this. Please could you help me by telling how to get high resolution on my unexpanded Vic

This is only one of many, many enquiries about graphics on the Vic — so we put all the letters in the hat and this is the one which came out.

It is indeed possible to obtain high-res graphics without buying the Commodore high-resolution pack: but unfortunately, it is not something which can be done by means of a few simple instructions. The Vic has no native Basic commands to produce high-res effects, unlike say the Apple or BBC micro.

You can think of a character displayed on the screen as consisting of an 8x8 square box of little lights, so that the character displayed depends on which lights are lit. The information to control which lights are lit for each character is contained in an area of memory called the character generator.

To display high-resolution graphics you are faced with the job of controlling each of these lights individually. So even plotting a straight line involves you in a fair amount of geometry, while drawing curves becomes a real headache! Also, this really needs to be done in assembler; Basic is much too slow.

Unless you want to spend many weeks developing your own graphics pack (which, unless you own a PROM programmer, will have to sit in RAM and eat up your free memory) you really have to resign yourself to saving up for the ROM pack (Editor's interpolation: We're reviewing it for the next issue).

Another fact to be borne in minds is that you will need extra RAM to run high resolution graphics; any Apple programmers will be well aware of how expensive on memory this is. The graphics pack does come with extra memory to cope with this.

Dear Tommy, At a recent evening class I spent an awkward five minutes trying to locate an error in one of the students' programs. At an INPUT statement, the Vic kept repeating REDO FROM START even though the input was numeric. The source of error was a limitation of Vic Basic when using an INPUT statement with a prompt of more than 20 characters. This can be overcome by using PRINT.

I must admit that I had not noticed this one! It is a bug in Basic all right, though a minor one. What is happening is that the **INPUT** statement thinks your prompt is part of the input; so if you have alpha characters in the prompt, you are getting the **REDO FROM START**. There used to be a similar funny in very old Pets, where the same thing happened if your reply to the **INPUT** ran over a line and caused the

screen to scroll. Sadly, we do not offer prizes for finding bugs in Basic (except boobies for Commodore).

Dear Tommy, Have you any information regarding the BBC computer program and how compatible the Vic-20 is to this project?

The BBC TV series **The Computer Programme** was intended to be a fairly machine-independent introduction to computing ideas. As such it will apply to the Vic as much as to any computer.

As regards compatibility between programs written to run on the Vic and the BBC micro, they will be compatible within limits. Both machines use the Basic programming language, although there are differences between the two dialects; the BBC micro has many facilities not present in Vic Basic, such as high resolution graphics commands without an extra ROM pack! However, Basic is a 'natural' language, which means that reading a program written in another dialect is fairly easy; so most programs which are not too machine dependent should be fairly easy to convert between the machines.

Dear Tommy, When I want to load a program which was written on the Vic without expansion into the Vic with 6.5KB it will not work. This only occurs with some programs; others will work without problems. What can I do?

The most likely problem here is the fact that the screen and colour memory areas move around the Vic when expansion is added. This is explained in great detail elsewhere in this issue: how fortunate!

Dear Tommy, Is it possible to reset the DATA pointer in a DATA file in such a way that the same file can be read many times in a program without having to just RUN or CLR more than once?

If you mean a data file which is held on a tape, you can reread the data merely by closing the file, rewinding the tape and opening the file again. If the file is on disk, just closing the file and reopening it will do the trick. If you mean data which is held in the program by means of **DATA** statements, the data pointer is reset to the start of data by means of the **RESTORE** statement (nothing to do with the **RESTORE** key on the keyboard).

Dear Tommy, I wish to connect an acoustic modem to the I/O port of my Vic-20. Can you please tell me how?

Before you can connect a modem to the Vic, you need an RS232 interface. The Vic does have a so-called RS232 interface, but the voltage levels are not compatible with **true** RS232 (0-5v instead of -12v to +12v). Such a device is however available from Stack (051-033 5511), who will also provide full details of the software required to drive an RS232 device.

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TINYMON1: A Simple Monitor for the Vic

by Jim Butterfield

One of the things you may miss on the Vic is a Machine Language Monitor: it's not there. Commodore will shortly be releasing a very powerful MLM on a plug-in cartridge, and serious programmers will certainly want to use it. (Editor's note: we have an advance copy for review — expect it next issue.) Meanwhile for occasional use, a tape-loaded MLM might be very handy. Here's one from Jim Butterfield.

TINYMON 1 should fit on any Vic, with or without extra memory added; and it honours all the commands from the built-in Monitors we know from Pet usage. One minor syntax change: the two addresses of the memory display command (.M) should be separated by a space rather than a comma.

It's not really practical to type TINYMON directly into a Vic. DATA statements in decimal would take up more room than is available in small Vics; and hex entry would need an MLM to be in place already. So I've prepared the program so that it can be entered on a Pet and saved on tape. After it's been created once, the Vic can make its own copies.

You'll need a Pet with Upgrade ROM or 4.0 ROM to do the job, since the original ROM Pets don't have a Machine Language Monitor and things would get too complicated.

TINYMON loads like a Basic program, and copies can be made with a simple LOAD and SAVE sequence as you would do with Basic.

When you load TINYMON and say RUN, however, some interesting things happen . . . the monitor system is repacked into the top of memory, and it will stay there until you turn the power off. You can say .X to return to Basic and load and run Basic programs, providing they are not too big. TINYMON grabs about 760 bytes of memory, so you lose a little space.

Once you're back in Basic, the question arises: how can you invoke TINYMON when desired? Not an easy trick, since memory is more mobile in the Vic than in the Pet.

The thing to do is to find a zero value in memory and SYS to that location. If you have a basic (5K) Vic, SYS 4096 is safe. The sure way is to PEEK first and ensure that there's a zero there (location 10 is often a zero).

This is TINYMON 1. Enter it on a Pet using the Machine Language Monitor, but first make the following changes:

```
.. 0028 01 04 18 08 18 18 08
```

Now start keying:

```
.. 0400 00 18 04 64 00 99 22 93
.. 0408 11 11 12 1d 1d 1d 20 54
.. 0410 49 4e 59 4d 4f 4e 20 00
.. 0418 31 04 6e 00 99 22 11 20
.. 0420 4a 49 4d 20 42 55 54 54
.. 0428 45 52 46 49 45 4c 44 22
.. 0430 00 4c 04 78 00 9e 28 c2
.. 0438 28 34 33 29 aa 32 35 36
.. 0440 ac c2 28 34 34 29 aa 30
.. 0448 37 38 29 00 00 00 ea ea
.. 0450 a5 2d 85 22 a5 2e 85 23
.. 0458 a5 37 85 24 a5 38 85 25
.. 0460 a0 00 a5 22 d0 02 c6 23
.. 0468 c6 22 b1 22 d0 3c a5 22
.. 0470 d0 02 c6 23 c6 22 b1 22
.. 0478 f0 21 85 26 a5 22 d0 02
.. 0480 c6 23 c6 22 b1 22 18 65
.. 0488 24 aa a5 26 65 25 48 a5
.. 0490 37 d0 02 c6 38 c6 37 68
.. 0498 91 37 8a 48 a5 37 d0 02
.. 04a0 c6 38 c6 37 68 91 37 18
.. 04a8 90 b6 c9 bf d0 ed a5 37
.. 04b0 85 33 a5 38 85 34 6c 37
.. 04b8 00 00 00 00 00 00 00 00
.. 04c0 bf 78 ad fe ff 00 ae ff
.. 04c8 ff 00 8d 16 03 8e 17 03
.. 04d0 a9 80 20 90 ff 58 00 00
.. 04d8 68 85 05 68 85 04 68 85
.. 04e0 03 68 85 02 68 85 01 68
.. 04e8 85 00 00 ba 86 06 38 a5
.. 04f0 01 e9 02 85 01 a5 00 00
.. 04f8 e9 00 00 85 00 00 20 b2
.. 0500 fe 00 a2 42 a9 2a 20 db
.. 0508 fd 00 a9 52 d0 1c a9 3f
.. 0510 20 d2 ff 20 b2 fe 00 a9
.. 0518 2e 20 d2 ff a9 00 00 85
.. 0520 27 20 40 fe 00 c9 2e f0
.. 0528 f9 c9 20 f0 f5 a2 07 dd
.. 0530 e6 ff 00 d0 12 85 1c 8a
.. 0538 0a aa bd ee ff 00 85 c1
.. 0540 bd ef ff 00 85 c2 6c c1
.. 0548 00 00 ca 10 e6 4c 4b fd
.. 0550 00 20 bd fd 00 90 f8 20
.. 0558 ee fd 00 20 bd fd 00 90
.. 0560 f0 20 ee fd 00 20 4c fe
.. 0568 00 f0 1f 20 b2 fe 00 a2
.. 0570 2e a9 3a 20 db fd 00 20
.. 0578 c5 fd 00 a9 05 20 6f fe
.. 0580 00 a5 c3 c5 c1 a5 c4 e5
```

```

: 0588 c2 b0 df 4c 50 fd 00 4c
: 0590 50 fd 00 20 fe fd 00 85
: 0598 c1 86 c2 60 a5 c2 20 cc
: 05a0 fd 00 a5 c1 48 4a 4a 4a
: 05a8 4a 20 e4 fd 00 aa 68 29
: 05b0 0f 20 e4 fd 00 48 8a 20
: 05b8 d2 ff 68 4c d2 ff 18 69
: 05c0 f6 90 02 69 06 69 3a 60
: 05c8 a2 02 b5 c0 48 b5 c2 95
: 05d0 c0 68 95 c2 ca d0 f3 60
: 05d8 20 0d fe 00 90 07 aa 20
: 05e0 0d fe 00 90 01 60 4c 4b
: 05e8 fd 00 a9 00 00 85 2a 20
: 05f0 40 fe 00 c9 20 f0 f9 20
: 05f8 20 fe 00 90 17 20 40 fe
: 0600 00 c9 30 90 10 20 35 fe
: 0608 00 06 2a 06 2a 06 2a 06
: 0610 2a 05 2a 85 2a 38 60 c9
: 0618 3a 08 29 0f 28 90 02 69
: 0620 08 60 20 cf ff c9 0d d0
: 0628 f8 68 68 4c 50 fd 00 a5
: 0630 91 c9 fe d0 05 08 20 cc
: 0638 ff 28 60 20 61 fe 00 2c
: 0640 2d 91 30 f8 60 20 4c fe
: 0648 00 d0 08 a9 03 85 9a a9
: 0650 00 00 85 99 60 85 1e a0
: 0658 00 00 20 af fe 00 b1 c1
: 0660 20 cc fd 00 20 a4 fe 00
: 0668 c6 1e d0 f1 60 20 0d fe
: 0670 00 90 0b a2 00 00 81 c1
: 0678 c1 c1 f0 03 4c 4b fd 00
: 0680 20 a4 fe 00 c6 1e 60 a9
: 0688 02 85 c1 a9 00 00 85 c2
: 0690 a9 05 60 e6 c1 d0 06 e6
: 0698 c2 d0 02 e6 27 60 a9 20
: 06a0 2c a9 0d 4c d2 ff a2 00
: 06a8 00 bd d0 ff 00 20 d2 ff
: 06b0 e8 e0 16 d0 f5 20 b2 fe
: 06b8 00 a2 2e a9 3b 20 db fd
: 06c0 00 a5 00 00 20 cc fd 00
: 06c8 a5 01 20 cc fd 00 20 99
: 06d0 fe 00 20 6f fe 00 4c 50
: 06d8 fd 00 20 fe fd 00 85 01
: 06e0 86 00 00 20 99 fe 00 85
: 06e8 1e 20 83 fe 00 d0 fb f0
: 06f0 ea 20 bd fd 00 a9 05 85
: 06f8 1e 20 83 fe 00 d0 fb f0
: 0700 dc 20 cf ff c9 0d f0 07
: 0708 20 bd fd 00 85 01 86 00
: 0710 00 a6 06 9a a5 00 00 48
: 0718 a5 01 48 a5 02 48 a5 03
: 0720 a6 04 a4 05 40 78 a6 06
: 0728 9a 6c 02 c0 4c 4b fd 00
: 0730 a0 01 84 ba 84 b9 88 84
: 0738 b7 84 90 84 93 a9 02 85
: 0740 bc a9 40 85 bb 20 cf ff
: 0748 c9 20 f0 f9 c9 0d f0 1a
: 0750 c9 22 d0 d9 20 cf ff c9

```

```

: 0758 22 f0 26 c9 0d f0 0b 91
: 0760 bb e6 b7 c8 c0 10 f0 c5
: 0768 d0 ea a5 1c c9 4c d0 e2
: 0770 a9 00 00 20 d5 ff 20 58
: 0778 fe 00 a5 90 29 10 d0 f0
: 0780 4c 50 fd 00 20 cf ff c9
: 0788 0d f0 e2 c9 2c d0 f0 20
: 0790 0d fe 00 29 0f f0 d3 c9
: 0798 03 f0 fa 85 ba 20 cf ff
: 07a0 c9 0d f0 ca c9 2c d0 e6
: 07a8 20 bd fd 00 20 cf ff c9
: 07b0 2c d0 f4 20 fe fd 00 85
: 07b8 ae 86 af 20 cf ff c9 20
: 07c0 f0 f9 c9 0d d0 ec a5 1c
: 07c8 c9 53 d0 f8 20 b2 fe 00
: 07d0 a9 01 85 b9 20 82 f6 4c
: 07d8 50 fd 00 0d 20 20 20 50
: 07e0 43 20 20 53 52 20 41 43
: 07e8 20 58 52 20 59 52 20 53
: 07f0 50 4d 52 58 47 3a 3b 4c
: 07f8 53 86 fd 00 b7 fe 00 23
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Inside the Vic printer by Chris Durham

Once Commodore had produced the Vic it was only a matter of time before a matching printer appeared, one which exhibited the same traits of cheapness, compactness and simplicity. The Vic-1515 is what we've been waiting for — a printer specifically for use with the Vic, plugging straight into the serial port without the need for any special interface unit. It's small, neat, cheap — and noisy. Chris Durham looks at the design, construction and usefulness of the new printer.

The printer comes with a mains lead fitted with a moulded (German) plug which has to be cut off before you can fit a standard plug. Also included are the cable to connect it to the Vic, one ribbon cartridge and the user handbook.

The printer is 6.75 ins deep, 13 ins wide and 5.25 ins high, so it really is compact. It comes in a cream/brown plastic case. It is a clean design, virtually indistinguishable from the Seikosha GP-80 — which is hardly surprising, as Seikosha built it for Commodore.

The printer has 5x7 dot matrix format and uses plain continuous stationery with a tractor feed. The paper is not a standard width, the range being 4.25 to 8 inches, but it is available from Commodore dealers — and some of them are selling it at a discount. The actual printing area is just over 6.5 ins wide at a character spacing of 12 characters per inch. This gives a total of 80 columns per line.

The thing prints at a speed of 30 characters per second, unidirectional, left to right. There is also an option to print double-width characters: see the print samples.

The fan-fold stationery will fit 66 lines to a page, considerably more than the 48 lines you got on the cheaper Pet printers. The printer will accept multiple-part stationery of an original plus two copies with an adjuster to vary the print pressure accordingly. There is a self-test facility built in to the printer.

A look inside

Removing the top half of the moulded case reveals a very compact piece of construction. The power supply transformer is located beneath the platen, the rectifiers and regulators are on the main circuit board: there are two large heat sinks on the regulators ensuring good heat dissipation.

The rest of the PCB, which is located vertically at the rear of the printer, contains a micro-processor and for the print control, the RAM

buffers, a collection of associated ICs and discrete components. There is only one actual socket on the board, containing the ROM chip; the microprocessor and all the other chips are soldered directly to the board. All external connections to the board are by 'plugs' which merely hold loose cables in contact with pins soldered to the board.

The print mechanism itself is comparatively simple. A single-hammer action is used: a revolving ridged drum rotates behind the paper, pushing it forward against the ribbon where the pins are set to give the relevant character.

The disadvantage of this sort of system is that because the striking action is a downwards 'wipe' rather than a single impact on the pins, straight lines can be rather wavy in appearance. This is not really noticeable on the alphanumeric characters, but some of the graphics characters can look a little ragged; for example, underlining a title can come out as rather less than elegant.

A single motor, located beneath the platen, drives both the drum and the print head through a plastic gear-train mechanism. The print head is pulled along the carriage by a wire and pulley system, with a spring tensioner to take up any slack. A powerful spring returns the print head when the pulley clutch is disengaged at the end of each line of printing. Two solenoids are used:

one operates the pulley clutch, the other operates the paper feed gear using a wire and spring system.

Using the printer

In many respects the handbook is very good, it leads in a logical manner through the stages of setting up the printer, running the self-test facility and explaining the various functions that are available.

On the other hand the proofreading was dire: there are numerous typesetting errors, and some strange sentence constructions crop up throughout the book — one or two paragraphs look as though they are literal translations from the Japanese. This spoils what would have been one of Commodore's better efforts at producing a handbook: and it could so easily have been avoided.

Fitting the paper is reasonably straightforward if you follow the rules in the handbook. It's not perfect, though. There are one or two points where the paper can snag as you try to slide it under the platen; and takes the novice several creased attempts before you realise it is easier to angle the paper slightly and try to get one corner through first. Once the paper is above the ribbon, fitting it over the tractor pins and locking it into place is easy.

There is a paper advance thumbwheel, which



It may just be the fact that I was using a new ribbon, but the clarity was superior to that on a Pet printer which gives a larger character size using the same matrix pattern. A number of people who have seen listings produced on this machine have been quite impressed by the quality from such a small printer.

You also get a lot of programmed flexibility. The microprocessor controller, together with the ROM, allows a number of control codes to be used either from a Basic program or direct from the keyboard. These cover such facilities as double-width characters, start position addressing, graphics mode, reverse field on and off and cursor up and down commands.

The onboard RAM ensures that the printer does not use any of the Vic's own memory so it can be used quite happily with the unexpanded Vic. There is also a facility to define and print your own graphics.

Although the print-head only prints from left to right it is 'logic-seeking' — which means it returns immediately after printing the last character on a line, instead of moving all the way to the end of the line. This is a definite advantage if a listing includes a number of short lines.

The printer will print a long line at 30 cps; but the overall speed is lower than this when printing a lot of short lines as the ratio of characters to carriage returns and line feeds drops. This is common on virtually all printers of this size however, and does not detract from the fact that for the sort of work this printer will be used for it is acceptably fast. A 400-line listing of 10KB program, for example took me just over eight minutes.

You may be wondering how the 80 column printer copes with the fact that the Vic can accept an 88 character line in Baisc? The answer is that the line wraps round quite happily on the printer in much the same way that it does on the screen of your TV.

The noise factor is normally a consideration when looking at a mechanical printer. The Vic-1515 has two 'soundproofing' covers: one is fixed inside at the back of the unit, the other is a removable top cover. Both are made of clear

plastic and without them the printer produces the kind of harsh screech that sends cats to hide in the airing cupboard (authentic editor's anecdote). With the covers the noise level is indeed reduced a bit: but there's no way the 1515 printer can be called 'soundproofed' under any circumstances. At least there has been a definite attempt to cut down as much as possible the noise that is generated, with a paper holding bar to reduce paper vibration for example. Don't expect to use it in the lounge though if someone else is watching their favourite serial on the TV — you would rapidly become very unpopular.

The Vic-1515 is a compact, well designed unit on the whole, with only one or two minor irritations. The handbook is logical and gives plenty of examples, if you can ignore the quaint English. The printer is intended for program listings, not word processing; and in view of that, it has a comprehensive set of commands and facilities for its size and price. It produces clear and quite readable text at a speed which will be acceptable to all but the most impatient user. It's quite noisy, but not unbearably so. And at least it's compact and reasonably cheap.

! " # \$ % & ' () * + , - . / 0 1 2 3 4 5 6 7 8 9 : ; < = > ? @ A B C D E F G H I J K L M N O P Q R S T U V W X Y Z [\] ^ _ ` | ~ { } ¡ ¢ £ ¤ ¥ ¦ § ¨ © ª « ¬ ® ¯ ° ± ² ³ ´ µ ¶ · ¸ ¹ º » ¼ ½ ¾ ¿ À Á Â Ã Ä Å Æ Ç È É Ê Ë Ì Í Î Ï Ñ Ò Ó Ô Õ Ö × Ø Ù Ú Û Ü Ý Þ à á â ã ä å æ ç è é ê ë ì í î ï ð ñ ò ó ô õ ö ÷ ø ù ú û ü ý þ ÿ



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Dear Vic

It is possible to **RUN** your programs automatically by pressing shift and **RUN/STOP** together. The screen will display '**LOAD**' and proceed as if you had typed it in as normal; when it has finished loading it will **RUN** the program without further intervention.

In case you are wondering where I got this useful piece of information, I discovered it quite by accident!

Christopher Hutber, Milton Keynes

Nice one. Does anyone else have serendipitous happenstances to contribute?

I was fascinated by the programs in the first issue (Summer 1981), especially the piano and the colour histogram. It is an interesting editorial decision to give people programs that do not work — it encourages them to solve the problems themselves. Would it be possible to be given a few clues about which programs do not work and maybe a flowchart or two?

Like others I am frustrated by the fact that Pet programs will not run on the Vic, but at least everyone will have to start all over again. So could I encourage further articles on converting software for Vic?

Nigel B. Keith-Walker, Oxford

Everything they say about sarcasm is true. On the other hand, it's only the deserved butts of the sarcasm of the sarcasm who claim it's the lowest form of wit: so the entire editorial team of **Vic Computing** is at this very moment committing ritual abasement upon itself, writing "NO MORE BUGS IN PROGRAM LISTINGS" in letters of fire upon the one thousand walls of Vic Computing Towers (now stop this silliness. Ed).

Still, we've taken to heart the idea about flowcharting on the grounds that a picture is worth more than a few words, even in **Vic Computing** — especially when it comes to explaining what's going on in a computer program. Expect to see more flowcharts in future!

More articles on Vic-Pet conversion are scheduled, and the first of them appears elsewhere in this issue.

The editor's claimed 16 Jumbo Jet crashes intrigue me. My own childhood ambition was to be a pilot — but at 60-plus it's a bit late. So simulation would satisfy a long-felt and deep-seated urge: where can I get a Jumbo Jet for my Vic? Are there any lists of Vic software?

Mr E. le Marquand, St Lawrence, Jersey

No, there's no comprehensive survey yet of what's available in software. Naturally enough, we plan to do one

ourselves (but that won't be until later in the year). Meanwhile, the advertisers in the magazine tend to be the larger Vic dealers, and that means they'll have most ready-to-go software: so it would certainly be worth asking for their catalogues.

But why not try writing your own games and simulations? Space Invaders and chess programs will be ten a penny (figuratively speaking) by the Autumn: but I bet there aren't too many people out there working on Jumbo jet simulations...

Incidentally, it was a previous editor who survived those crashes. This one still awaits his first, though some experiences are almost as bad — for instance, having to watch **Orca** the Killer Whale on transatlantic flights.

Further to your reply in the Christmas 81 Computing to P. Croxford ('Vic into Pet won't go'), your comments are rather confusing although I am sure correct. Could I suggest the following, which is an easier approach in my opinion:

For programs from the standard 5K Vic to run on a Pet, type...

POKE 4096,0
POKE 41,16
clr

For a Vic plus the 16K memory expansion cartridge, type...

POKE 4608,0
POKE 40,1
POKE 41,18
clr

Missing out the POKE 4608,0 will allow one to list the program, but not to run it from the first program line. I have seen published only the last three commands and that caused me problems initially.

I have recently obtained the 16K cartridge for my Vic-20 and run my programs on a PET 8032: I can assure you the above definitely works.

These commands can be typed in before or after you load your program, it doesn't seem to matter.

J. Hall, Ladybank, Fife

Looks good. See also Chris Preston's article in this issue.

The 'repeating patterns' program in **Victuals** was great — but isn't Mr (Ms?) Pidd a self-effacing person? How many of us voluntarily put the REMarks about the program's title and authorship at the end rather than the beginning of the code?

Steven Pratt, Sale, Cheshire

Ah well, that just goes to demonstrate the folly of starting programs at line

number 1 — it leaves no room for self-aggrandisement when you finish the thing. Let all novice programmers take note!

I have one of the first Vics which was imported. It was made in Japan, and appears to have a different chip layout to the West German machines. Although I am not sure, I believe that it contains an EPROM which makes me think it may have been a development machine. I do not however want to change it as I use it daily for schoolwork and home interests.

I am a little concerned with the prices of the expansion units which are available, both from Commodore, and any others. I received firm assurances from everyone involved with the Vic sales drive that these peripherals would be very cheap. Whilst these prices are cheap now, they were forecast to be much cheaper at the start — which is surely where we are at.

I bought a Vic on the understanding that things would be cheap; now I'm not sure if it's the right machine for me. The BBC Micro looks extremely attractive, especially with the option of Prestel and tele-software (direct-downloading). Networking also appeals as well.

Expansion on the Vic looks limited, too; even with a seven-slot motherboard this leaves only one slot left for any other operating system package or program. I would need at least 10 sockets to satisfy my desires for expansion.

This does not mean that I am going to forsake my machine for something bigger, I am going to stick with it and hope that something comes up.

Simon Clark, Towcester, Northants

It's all relative. What constitutes a 'cheap' computer? There are inescapable production costs associated with all the bits and pieces that go into building any computer, and there are inescapable marketing and support costs that the manufacturer has to bear as well. Then he's got to make a bit on top for the shareholders (and in Commodore's case the management's fleet of executive jets too).

We don't think the Vic is bad value for money at all — but then that's not really Simon's point. He is talking about his expectations and his disappointments; and those we can understand. But there's no way any computer is going to be as cheap as say pocket radios and still include a keyboard, a video controller, a Basic, and a means of storing programs.

But it is all relative: and we don't think the Vic does too badly there, either. We have commissioned a comparison between the BBC micro and the Vic,

and frankly the preliminary reports suggest that the BBC machine is considerably more powerful. But be reasonable — what do you expect from something that costs twice as much? The Vic is still below £200, it's available instantly, there's a good deal of expansion possibilities in the pipeline, there is a lot of software available for it already with a good deal more to come, there's a large and growing user community to share ideas and tips (and maybe to act as a ginger group to gee up the people at Commodore Towers!). What's more, there's a Truly Wonderful Little Magazine dedicated to the computer.

There's no other 'home' computer that offers you anything like that. The BBC machine may be technically superior, but you'll be paying more for those extra goodies (always assuming you can find someone at the Beeb who's interested in taking your money — no-one concerned with the project seems very keen on actually selling the things to the punters like you and me).

Yes, expansion on the Vic is currently limited — but we think that independent suppliers (like Stack) will find ways around that; and we think that networking and ingenious multiplexing will both appear for the Vic before the year is out.

There is a comment I would like to make on a book that has been published with games for the Vic. The book in question is **Getting Acquainted With Your Vic-20**. Having tried a few games I asked my nephew (who is working in computers) for help: he said it seems they have been made up for another computer. It can help, I know, to work things out for oneself: but some errors in the book are real hangers-ups (sic).

B. Gregory, London SW6

This is one of several complaints we have had about Tim Hartnell's book, and it was among the milder ones. Mr Hartnell's first money-making opus was **Getting Acquainted With Your ZX-80**, and the programs in that tome bear a striking family resemblance to those in **Getting Acquainted With Your Vic** — except that those in the Sinclair version reportedly worked.

Lord knows we've had our own problems with testing printed programs and then trying to reproduce them in the magazine. But we do acknowledge our mistakes, and we do seek to correct them. We cannot recommend the book **Getting Acquainted With Your Vic-20**.

In your first issue Chris Preston says that it's not possible to test for the shift key on Vic. This is not so. After some PEEKing I found that both location 653 and 654 can help us with this. If the shift key is pressed, PEEK (653) = 1 (ie bit 0 is set); if the CBM key is pressed, bit

Send us comments, queries and complaints: we'll answer everything we can and print anything that isn't boring or illegal. Address yourself to The Editor, Vic Computing, 39-41 North Road, London N7 9DP

I is set; if the CTRL key is pressed, bit 2 is set.

These can of course be combined giving a total of eight combinations.

Another interesting thing occurs if you POKE the 'current colour' byte 646 with a value eight higher than the eight-colour POKE codes (0-7). The characters get a shade and they get two colours! One colour (the right part of the character) is equal to PEEK (646)-8 and the other is the same as the current border colour.

Anon, Stavanger

He means a shadow, not a shade — but it's a fun effect: try it! (Sorry about that 'anon', by the way; we couldn't decipher the signature).

What happened to Vic Rhino?

J. Chapman, London SW6

There are two printing errors in the text for last month's Vic Rhino program — neither should have been too disastrous, but that's no excuse. Sorry.

Line 200 is mentioned as setting up the screen, and of course it should be line 2000; and several people searched in vain for 'diagram 1', which was inad-

vertently omitted (it just illustrated the way you can jump diagonally between trees while the rhinos can't).

More serious, some copies of the magazine came with the rhino listing printed badly. This particularly affected the way the Vic printer prints the screen control codes, some of which were illegible on the affected copies. Henceforth we're including a summary panel in **Victuals** that should help out in future. Meanwhile anyone who had one of the duff copies is welcome to drop us a line and we'll send you a hot-from-the-printer printout of the Vic Rhino listing. Letters only, please, no phone calls.

Our children are particularly interested to learn when you expect to deliver the 'advanced' games to be run on the Vic — such as chess, space invaders, etc. Our local Commodore Dealer has been unable to give us any firm indication when these games will be released, other than to advise they will be stored on a silicon chip rather than magnetic tape.

F. L. Hancock, Bramhall, Cheshire

Well, they're Commodore's games and not ours: but we exercised our contacts among the ranks of the Vic-makers and can confidently report that a number of plug-in ROM-pack games

should now be available — Jelly Monsters, Star Battle and Rat Race were all due for release to the dealers at the end of March. They have been delayed by manufacturing hold-ups in Japan, where the chips are being made.

Also due out about now is the first of Commodore's own cassette games, Blitz. We'll be reviewing all of these, naturally.

As for more advanced games, there's a lot of goodies in the pipeline with release dates "to be announced". They include interactive 'Adventure'-type games, a Music Composer that Thorn-EMI is developing for Commodore, and chess too. They will all be ROM packs.

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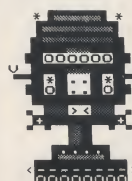
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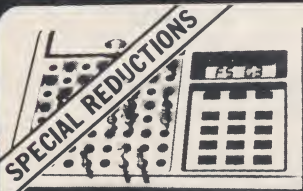
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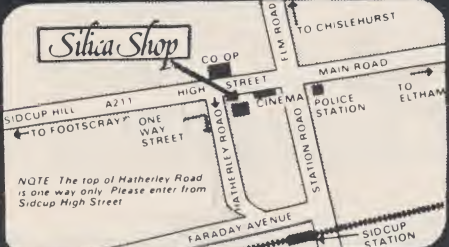
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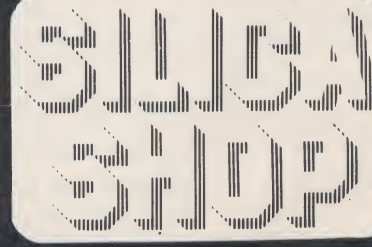
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An editor for instant character creation

Frustrated by the length of time it takes to build your own characters on the Vic? Depressed by how fiddly high-resolution graphics can be?

Fret not — here's an instant solution. At enormous expense, Vic Computing is proud to bring you a ready-to-go editor for programmable characters. With it you can create your own graphic symbols for games, build foreign language character sets, incorporate mathematical and scientific symbols into your displays, and indeed set up any other special-purpose visuals you might want to use in your Basic programs — just as you use any of the standard Vic letters, numbers and graphics shown on your keyboard.

The editor came to us courtesy of Commodore UK. Right now it's being sold for folding money elsewhere in the world. But the boys in Slough have decided to be nice to us all and gave it to our esteemed journal free, gratis and for nothing.

Typing it in is going to be a major project for anyone, but persevere — it's worth it.

The really good news is that you don't have to be an experienced programmer to play with this editor: it's dead easy to use. Everything you need to create a character is displayed on a single 'editing' screen, and this shows you the full definable alphabet (64 characters): the symbol you're currently working on (extra large and easy to read); and a menu of the editing commands you can use.

There is one small potential problem. The editor will run on a standard Vic or one with a 3K memory expansion, but it won't work on a Vic expanded past 3K. This is intentional, since the Vic cannot use external memory for character or screen area.

Here's how it works. You select 64, 128 or 192 characters from the Vic's standard alphabet of 256 — these are the characters you'll be replacing. (The maximum replacement you can work with at one time is 64; but there's a way to get around that — see next issue's exciting instalment.)

Don't forget that you are actually replacing characters. When you've built a wonderful new character of your own, it displaces one of the characters in the existing set of 64: and thereafter only the characters you create can be used in your Basic programs. That means you will have to be a bit wary about exactly which characters you replace.

There are dozens of less than vital characters on the Vic, of course, so you shouldn't have many problems unless you want a load of new symbols. The editor lets you define and retain ('MASK') any standard Vic characters, such as letters, which you might want to use as well as your newly added creations.

If you're redefining the alphabet — creating different shaped letters or a foreign language alphabet — you'll probably choose to replace the standard letters and numbers displayed on the keyboard. If you're designing game graphics or adding special notation symbols, you could replace those characters you don't use very often, like the left and right brackets or the up-arrow and back-arrow, the dollar sign, or the backslash.

The best way to show you how the editor works is to give you an actual example so let's walk through the commands.

SETP 1: When you RUN the editor, the Vic asks you if you want to KEEP CHARS? — in other words, do you want to keep a character set which you have already defined? You haven't defined a special set yet, so type 'NO' and hit RETURN.

BLOCK	SET 0	SET 1
0	upper case	lower case
1	graphics	upper case
2	reversed upper case	reversed lower case
3	reversed graphics	

STEP 2: You are now asked if you want to MASK CHARS? — should the Vic display a 64-character portion of the standard character set? If you're not replacing characters, if you are just creating brand new ones from scratch to overwrite the existing character set, you'd respond with 'NO'. In practice you will almost always want to retain some of the standard characters; and in any case, for this run-through the answer is YES.

STEP 3: So you are now asked which part of the standard character set you want to choose from, the upper case/graphics set or the upper/lower case set. These the editor calls set 0 and set 1 respectively the chart shows exactly which characters are included in which, and further divides each of them into four 64-character 'blocks'.

The screen should now be asking you to specify which SET you want. You can choose either: for the purposes of this example, opt for 0.

STEP 4: You're now asked for a BLOCK. Check the chart: again, you could type any of the blocks numbers — but type 0 for this example to get the upper-case block in set zero.

STEP 5: The editor gives you the chance to display several characters together at one time. This is for building large pictures from multiple characters. The question DISP: H, W? asks what dimensions you want in the display: the maximum is four characters high (H) by three characters wide (W). You could choose to have a 2x2 display, or any other combination within the 4x3 character maximum limit. For now, try typing '4,3'.

STEP 6: Right, you should now have a screen display on which you actually begin to redefine your own programmable characters.

You see a summary of the edit commands available: at the bottom are the 64 characters in the set and block you've elected to redefine: and immediately above them is the single character which happens to be the first character in that set.

You don't of course have to replace all the 64 characters you can see. The character you're currently working with is highlighted in yellow. The characters along the bottom are numbered consecutively from 0 to 63. The first character displayed on the screen is character zero: if you're using block 1 and set 0, this character should be the '@' sign.

The main action is happening in an oversized 8x8 matrix in the centre of the screen. You build your special character by putting dots in the positions in this matrix — actually, asterisks are used instead of dots.

The way to redefine this character is to move the cursor around the large 8x8 display square — use the standard up/down and left/right cursor keys plus HOME (to get to the top left corner) and RETURN (to get to the start of the line).

To create a dot in one of those 8x8 positions, type an asterisk: to erase a dot hit the SPACE bar.

As you go, you'll notice that directly under the large working display is a real-size replica of the character you're defining so you can see how it will look when used in anger.

STEP 7: When you're satisfied with the new shape you've created type 'N' for NEXT character and hit RETURN. This causes the next character in sequence, character number 1, to appear in the 8x8 square; it should be A, and you can now redefine it if you want to. You'll also notice that down at the bottom the asterisk in the character set has been replaced with your new character.

STEP 8 Alternatively you can leave it alone and go looking for a different one to replace. There's a neat GOTO option which lets you go to any number in the character set. You type 'G' and when you get the CHAR? message you key the sequence number of the character you want. Now, the characters down at the bottom aren't numbered; so unless you are prepared to count them on the screen (a bit tedious) just try a heuristic approach — in other words, have a guess. It doesn't commit you to anything, so if you don't hit the character you want keep on using GOTO to reach it.

By the way, don't bother trying '64'; the characters are numbered from 0 upwards. This time around try keying 36 — it should bring on to the display the dollar sign. And now you can redefine that:

STEP 9: try the `R` (for `REPLICATE`) command, which lets you repeat a particular character in more than one position. So set up your new character to replace one item of the standard charset, then key `R` and specify another character number in response to the question you'll get. On the screen will appear the shape of the character normally at that position, just so's you can check it's the one you want. Now hitting `RETURN` will cause that character to be replaced by the new one you've set up, and the panel at the bottom will now show two occurrences of your creation.

```

1 PRINT"THE CHARACTER EDITOR BY ANDY FINKEL 300(C)1981 BY COMMODORE
2 POKE51,0:POKE52,28:POKE55,0:POKE56,28:CL=30720:C0=32768:C2=7168:SB=7680:B=7841
3 DEFN(A(I)=N*8+I+Y:DEFFN(B(J)=-(ZAND2↑(7-J))>0)*170-(ZAND2↑(7-J))=0)*160
4 Y=36869:B2=7873:BL$=" "
5 THEN10
6 POKEV,255:PRINT"KEEP CHARS?";:GOSUB59:IFA$<"N"THEN10
7 PRINT"MASK CHARS?";:GOSUB59:IFA$="N"THENFORI=0TO511:POKEI+C2,0:NEXT:GOTO10
8 PRINT"SET(0:1)";:GOSUB59:I=VAL(B$)
9 A=A*64+I*256:FORI=0TO511:POKEI+C2,PEEK(I+C0+A*8):NEXT
10 PRINT"MASK ISP:H,W?";:GOSUB59:DL=VAL(LEFT$(B$,1))-1:DW=VAL(RIGHT$(B$,1))-1
11 IFDW<0ORDL<0ORDW>20ORDL>3THEN10
12 RESTORE:PRINT"J":A=1:N=0:FORJ=0TODL:FORJ=0TODW:POKEB2+I*22+J,0:NEXTJ,I
13 READJ,K:IFJ>0THENFORI=0TO7:POKEJ*8+SB+I,PEEK(K*8+32768+I):NEXT:GOTO13
14 DATA6,160,7,170,8,131,9,136,10,129,12,146,13,148,19,133,30,147,35,132,41,137,
15 42,143,0,0
16 PRINT"LOAD FILE?";:FORI=8098TO8119:POKECL+I,3:POKEI,173:NEXT
17 FORI=81TO81+63:POKEI+CL,6:POKEI,I-8120:NEXT:GOSUB52
18 PRINT"LOAD MASK?";:FORI=8098TO8119:POKECL+I,3:POKEI,173:NEXT:GOSUB52
19 OR=B:X=0:Y=0
20 CS=PEEK(OR):POKEOR,-(CS=160)*70-(CS=170)*71
21 GETA$:IFA$=""THEN20
22 IFA$="L"THENPRINT"NAME:";:GOSUB59:POKEV,240:LOADB$,1,1:CLR:RUN
23 IFA$="S"THENX=0:Y=0:GOTO51
24 IFA$="J"THENFORI=0TO7:POKEC2+N*8+I,256+NOT(PEEK(C2+N*8+I)):NEXT:GOSUB52:GOTO1
25 IFA$="Q"THENFORI=0TO7:POKEN*8+C2+I,0:NEXT:GOSUB52:GOTO18
26 IFA$="O"THENPOKE52,30:POKE56,30:PRINT"DATA":POKEV,240:PRINTCHR$(9):POKE50,0:EN
27 IFA$<"S"THEN36
28 POKEV,240:PRINT"SAVE OR LIST?";:GOSUB59:IFA$="S"THEN33
29 C$="":A=3:PRINT"TO PRINTER?";:GOSUB59:IFA$="Y"THENA=4:C$="J"
30 OPEN4,A:FORI=0TO62STEP8:PRINT"J":FORJ=0TO7:PRINT#4,C$+DATA$STR$(I+J)::FORA=0T
31 PRINT#4,"MID$(STR$(PEEK(A+C2+(I+J)*8)),2)::NEXT:PRINT#4:NEXTJ
32 IFC$=""THENPRINT"QUIT RETURN":GOSUB59
33 NEXTI:CLOSE4:POKEV,255:GOTO12

```

```
33 p=1:pNKF173,0:pNKF173,20:pNKF174,0:pNKF175,30:pNKF103,0:pPNT"NAME":":G0G1B5
```


A matter of routines

SORTS!

Why re-invent the wheel? Everyone needs useful subroutines to drop into programs — and sooner or later everyone writes at least one. Send us your best efforts for the general good.

Julian Ravest kicks off our first **Matter of Routines** with a strong contribution — two routines for sorting data.

They are good enough for practically any sort requirements, except when you've got too much data to fit into memory — then you'd need some kind of sophisticated disk-based sort/merge. But for most foreseeable Vic uses, these are fine.

Programs need at some point a routine for placing data in order. If there are only a few elements to be sorted, and the routine is not required frequently, a simple method such as Bubblesort is adequate..

But Bubblesort, though easy to code, is very inefficient and takes a long time to complete the sort. Quicksort is a alternative method well known to programmers — it is much faster and can be used with advantage in place of a Bubblesort whenever there are more than about 10 elements to be ordered.

In the examples of each method it is assumed that a string array, A\$(), of N elements is to be sorted. The routines given will work equally well with numeric arrays.

Bubblesorts

In the routine BUBBLESORT 1 the computer compares each pair of elements in turn (line 130). If they are not in the desired order they are interchanged (line 140) and a flag set (variable T). After passing once through the array a check is made to see if any changes have been made and, if so, another pass is made (line 160). Line 110 resets the flag before each new pass. When a pass of no interchanges has been made the array must be fully ordered.

A somewhat faster routine can be produced when you realise that on each pass another element is swept to its correct position at the end of the array. It is therefore a waste of time to examine them; BUBBLESORT 2 progressively decreases the length of each pass by the use of variable M, which counts the number of passes and hence the number of correctly placed elements.

Both these examples put the data into ascending order. Simply reversing the comparison in line 130 by replacing "<" with ">" produces a descending order.

Quicksort

Although Quicksort is a much more complex piece of coding its greater efficiency makes it very much more powerful. This is because each interchange of elements brings that element closer to their final position than is the case with the exchanges of adjacent elements in Bubblesort routines.

The Variables SR(1) and SL(1) denote the limits of the array to be sorted. Since these need not coincide with the ends of the array they can be used to mark a section of the array for ordering. To obtain a descending order in the final array it is necessary to reverse the comparisons in lines 150 and 160.

In some programs there is an advantage in joining a number of strings together to form a composite string. For example, the first 15 characters of a string may contain a name while the next 10 holds a reference number. The routine given for quicksort would sort such strings according to name; but what if you wanted to order them by reference number?

The solution is to use the MID function. The lines 140, 150 and 160 are changed to:

```
140 I = L : J = R : X$ = MID$( A$(INT
    ((L + R)/2)),16,10)
150 IF MID$(A$(I),16,10)< X$ THEN I =
    I + 1 :
    GOTO150
160 IF X$<MID$(A$(J),16,10)THEN J =
    J - 1 :
    GOTO160
```

A similar trick may be used with bubblesorts.

Note that if Quick QUICKSORT is used in a subroutine, line 110 must be declared earlier in the program and not in the subroutine. Failure to observe this will result in a REDIM'D ARRAY error message.

The superiority of Quicksort

In order to test these routines each of them was used to sort ordered arrays consisting of strings of five random characters. The time taken to complete the sorts as well as the number of comparisons made and the number of interchanges for arrays of 100 elements are shown in the table.

The time advantage of BUBBLESORT 2 over BUBBLESORT 1 is clearly shown to be the result of fewer comparisons. The spectacular advantage of QUICKSORT over the other two is also clear.

The gain becomes still greater when larger arrays are sorted: An array of 400 elements was ordered by BUBBLESORT 2 in 66 minutes, a similar array was dealt with by QUICKSORT in 2.5 minutes. There were 921 exchanges as opposed to 39,609! The moral is obvious.

Routine	Time taken (seconds)	No. of comparisons	No. of exchanges
BUBBLESORT 1	125	6716	2474
BUBBLESORT 2	95	2333	2522
QUICKSORT	14	448	177

Comparison of routines for sorting an array of 100 strings of five characters each. (Results are an average of six runs).

BUBBLESORT 1

```
1100 REM BUBBLESORT 1 ROUTINE
1100 T = 0
1120 FOR I = 1 TO N-1
1130 IF A$(I)<A$(I+1) GOTO 1150
1140 W$ = A$(I): A$(I) = A$(I+1):
    A$(I+1) = W$:T = 1
1150 NEXT
1160 IF T = 1 GOTO 110
```

ENTER ROUTINE WITH: Array A\$() of N elements to be sorted
VARIABLES USED IN ROUTINE: T,I,W\$
EXIT ROUTINE WITH Array A\$() sorted in ascending order

BUBBLESORT 2

```
1100 REM BUBBLESORT 2 ROUTINE
1105 M = 1
1110 T = 0
1120 FOR I = 1 TO N-M
1130 IF A$(I)<A$(I+1) GOTO 1150
1140 W$ = A$(I): A$(I) = A$(I+1):
    A$(I+1) = W$: T = 1
1150 NEXT
1155 M = M + 1
1160 IF T = 1 GOTO 1110
```

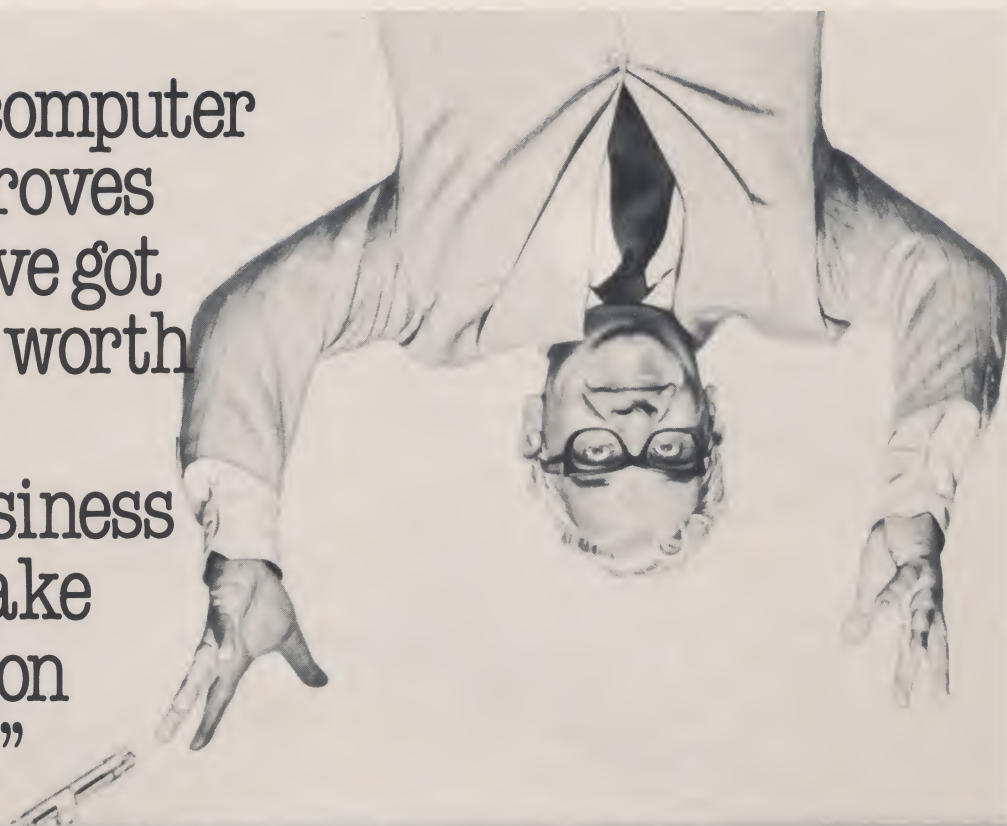
ENTER ROUTINE WITH: Array A\$() of N elements to be sorted
VARIABLES USED IN ROUTINE: T,M,I,W\$
EXIT ROUTINE WITH: Array A\$() sorted in ascending order

QUICKSORT

```
1100 REM QUICKSORT ROUTINE
1110 DIM SL(16), SR(16)
1120 S = 1: SL(1) = 1: SR(1) = N
1130 L = SL(S): R = SR(S): S = S + 1
1140 I = L: J = R: X$ = A$(INT
    ((L + R)/2))
1150 IF A$(I)<X$ THEN I = I + 1:
    GOTO 1150
1160 IF X$<A$(J) THEN J = J - 1:
    GOTO 1160
1170 IF I>J GOTO 1190
1180 W$ = A$(I): A$(I) = A$(J):
    A$(J) = W$:
    I = I + 1: J = J - 1
1190 IF I<=J GOTO 1150
1200 IF I>=R GOTO 1220
1210 S = S + 1: SL(S) = I: SR(S) = R
1220 R = J: IF L<R GOTO 1140
1230 IF S<>0 GOTO 1130
```

ENTER ROUTINE WITH: Array A\$() of N elements to be sorted
VARIABLES USED IN ROUTINE: SL(16), S,L,R,I,J,X\$,W\$
EXIT ROUTINE WITH: Array A\$() sorted in ascending order

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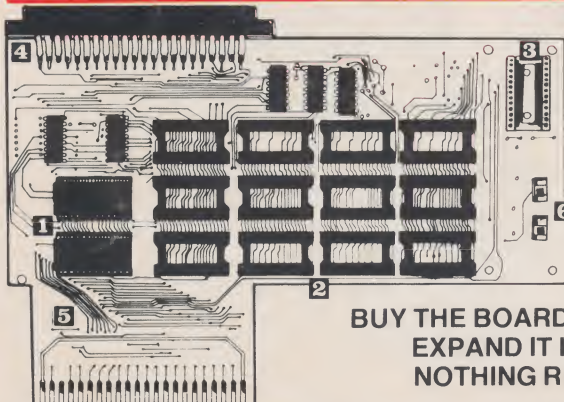
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HELP
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READY

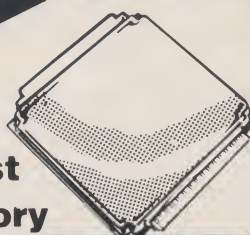
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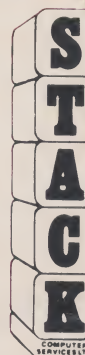
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